



# **CERTIFICATION TEST REPORT**

**Report Number. : 13019133-E1V3**

**Applicant :** APPLE, INC.  
1 APPLE PARK WAY  
CUPERTINO, CA 95014, U.S.A.

**Model :** A2282

**FCC ID :** BCGA2282

**EUT Description :** NETWORK ADAPTER

**Test Standard(s) :** FCC 47 CFR PART 15 SUBPART C

**Date Of Issue:**  
April 28, 2020

**Prepared by:**

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## REPORT REVISION HISTORY

| Rev. | Issue Date | Revisions                                  | Revised By |
|------|------------|--|------------|
| V1   | 4/13/2020  | Initial Issue                              | Tony Li    |
| V2   | 4/24/2020  | Address TCB's Questions                    | Chin Pang  |
| V3   | 4/28/2020  | Retest BLE 2M to frequency range 2404-2478 | Chin Pang  |

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** APPLE, INC.  
1 APPLE PARK WAY  
CUPERTINO, CA 95014, U.S.A.

**EUT DESCRIPTION:** Network Adapter

**MODEL:** A2282

**SERIAL NUMBER:** F0TC301FPQD7 (CONDUCTED)  
F0TC3000PQD7 (RADIATED)

**DATE TESTED:** 01/23/2020 – 2/04/2020 & 4/27-28/2020

| APPLICABLE STANDARDS     |              |
|--------------------------|--------------|
| STANDARD                 | TEST RESULTS |
| CFR 47 Part 15 Subpart C | Complies     |

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released For  
UL Verification Services Inc. By:



Chin Pang  
Senior Engineer  
Consumer Technology Division  
UL Verification Services Inc.

Prepared By:



Tony Li  
Test Engineer  
Consumer Technology Division  
UL Verification Services Inc.

## 2. TEST RESULTS SUMMARY

| FCC Clause     | Requirement                  | Result                  | Comment                              |
|----------------|------------------------------|-------------------------|--------------------------------------|
| See Comment    | Duty Cycle                   | Reporting purposes only | ANSI C63.10 Section 11.6.            |
| See Comment    | 99% OBW                      | Reporting purposes only | ANSI C63.10 Section 6.9.3.           |
| 15.247 (a) (2) | 6dB BW                       | Complies                | None.                                |
| 15.247 (b) (3) | Output Power                 | Complies                | None.                                |
| See Comment    | Average power                | Reporting purposes only | Per ANSI C63.10, Section 11.9.2.3.2. |
| 15.247 (e)     | PSD                          | Complies                | None.                                |
| 15.247 (d)     | Conducted Spurious Emissions | Complies                | None.                                |
| 15.209, 15.205 | Radiated Emissions           | Complies                | None.                                |
| 15.207         | AC Mains Conducted Emissions | Complies                | None.                                |

### 3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01.

### 4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

| 47173 Benicia Street                                       | 47266 Benicia Street                                       | 47658 Kato Rd                                    |
|--|--|--|
| <input type="checkbox"/> Chamber A (IC:2324B-1)            | <input type="checkbox"/> Chamber D (IC:22541-1)            | <input type="checkbox"/> Chamber I (IC: 2324A-5) |
| <input checked="" type="checkbox"/> Chamber B (IC:2324B-2) | <input checked="" type="checkbox"/> Chamber E (IC:22541-2) | <input type="checkbox"/> Chamber J (IC: 2324A-6) |
| <input type="checkbox"/> Chamber C (IC:2324B-3)            | <input type="checkbox"/> Chamber F (IC:22541-3)            | <input type="checkbox"/> Chamber K (IC: 2324A-1) |
|  | <input type="checkbox"/> Chamber G (IC:22541-4)            | <input type="checkbox"/> Chamber L (IC: 2324A-3) |
|  | <input type="checkbox"/> Chamber H (IC:22541-5)            | <input type="checkbox"/> Chamber M (IC: 2324A-2) |

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

## 5. DECISION RULES AND MEASUREMENT UNCERTAINTY

### 5.1. METROLOGICAL TRACEABILITY

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 5.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

### 5.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| PARAMETER   | $U_{Lab}$ |
|---|-----------|
| Worst Case Conducted Disturbance, 9KHz to 0.15 MHz  | 3.39 dB   |
| Worst Case Conducted Disturbance, 0.15 to 30 MHz    | 3.07 dB   |
| Worst Case Radiated Disturbance, 9KHz to 30 MHz     | 2.52 dB   |
| Worst Case Radiated Disturbance, 30 to 1000 MHz     | 4.88 dB   |
| Worst Case Radiated Disturbance, 1000 to 18000 MHz  | 4.24 dB   |
| Worst Case Radiated Disturbance, 18000 to 26000 MHz | 4.37 dB   |
| Worst Case Radiated Disturbance, 26000 to 40000 MHz | 5.17 dB   |

Uncertainty figures are valid to a confidence level of 95%.

### 5.4. SAMPLE CALCULATION

#### RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

Field Strength (dB<sub>UV</sub>/m) = Measured Voltage (dB<sub>UV</sub>) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

$$36.5 \text{ dB}_U + 18.7 \text{ dB}/m + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dB}_U/m$$

#### MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

Final Voltage (dB<sub>UV</sub>) = Measured Voltage (dB<sub>UV</sub>) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.

$$36.5 \text{ dB}_U + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dB}_U$$

## 6. EQUIPMENT UNDER TEST

### 6.1. EUT DESCRIPTION

The EUT is a Network Adapter. It has an integral battery, two Gigabit Ethernet port, lightning connector and antenna. The device supports IEEE 802.11b/g/n radio, Bluetooth radio, and GNSS. Network Adapter comes with 32 GB memory storage and 1GB RAM.

Note: Only BLE (1M/2M) was turn on, other option on Bluetooth, HDR4/HDR8 were turn off.

### 6.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

| Frequency Range (MHz) | Mode   | Output Power (dBm) | Output Power (mW) |
|-----------------------|--------|--------------------|-------------------|
| 2402 - 2480           | BLE 1M | 7.26               | 5.32              |
| 2404 - 2478           | BLE 2M | 7.24               | 5.30              |

### 6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an PCB/Omni directional antenna.

| Frequency Range (GHz) | Antenna (dBi) |
|-----------------------|---------------|
| 2400-2484             | 3             |

### 6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was 1A610

## 6.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 1GHz, above 18GHz, and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on low, middle and high channels.

The fundamental and emission spurious of the EUT were investigated in three orthogonal orientations X,Y,Z with EUT connected to both Laptop and Switch/Router via ethernet cable and EUT standalone configuration.

For above 1GHz, it was determined that Y (Landscape) orientation was the worst-case orientation with EUT standalone; therefore, all final radiated testing was performed with the EUT in Y (Landscape) orientation.

For below 1GHz, it was determined that Y (Landscape) orientation was worst-case orientation with EUT connecting to both Laptop and Switch/Router via ethernet cable

Radiated emissions below 30MHz, below 1GHz, 18-26GHz and power line conducted emissions were performed with the EUT transmits at the channel with the highest output power as worst-case scenario

For below 30MHz and 1GHz tests EUT was connected to AC power adapter and support equipment with ethernet cable connected as the worst case; and for above 1GHz, the worst-case configuration was EUT only. There were no emissions found below 30MHz within 20dB of the limit. For AC line conducted emission was investigated with AC power adapter and with laptop.

## 6.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

| Support Equipment List |              |             |                   |        |
|------------------------|--------------|-------------|-------------------|--------|
| Description            | Manufacturer | Model       | Serial Number     | FCC ID |
| Laptop                 | Apple        | MacBook Pro | C02SG8L0G8WP      | DoC    |
| Laptop AC/DC adapter   | Apple        | A1435       | C046042GFYFG6HKAY | NA     |
| EUT AC Adapter         | Apple        | A1385       | D29325SM03XDHLHC9 | NA     |
| 8 Port Gigabit Switch  | Netgear      | GS108v3     | 2162993A02E62     | DoC    |
| AC Adapter             | Netgear      | T012LF1209  | 929038795         | DoC    |

### I/O CABLES (Conducted)

| I/O Cable List |         |                      |                |             |                  |                      |
|----------------|---------|----------------------|----------------|-------------|------------------|----------------------|
| Cable No       | Port    | # of identical ports | Connector Type | Cable Type  | Cable Length (m) | Remarks              |
| 1              | AC      | 1                    | AC             | Un-Shielded | 2                | N/A                  |
| 2              | USB     | 1                    | USB-C          | Shielded    | 1                | N/A                  |
| 3              | Antenna | 1                    | SMA            | Un-Shielded | 0.2              | To spectrum Analyzer |

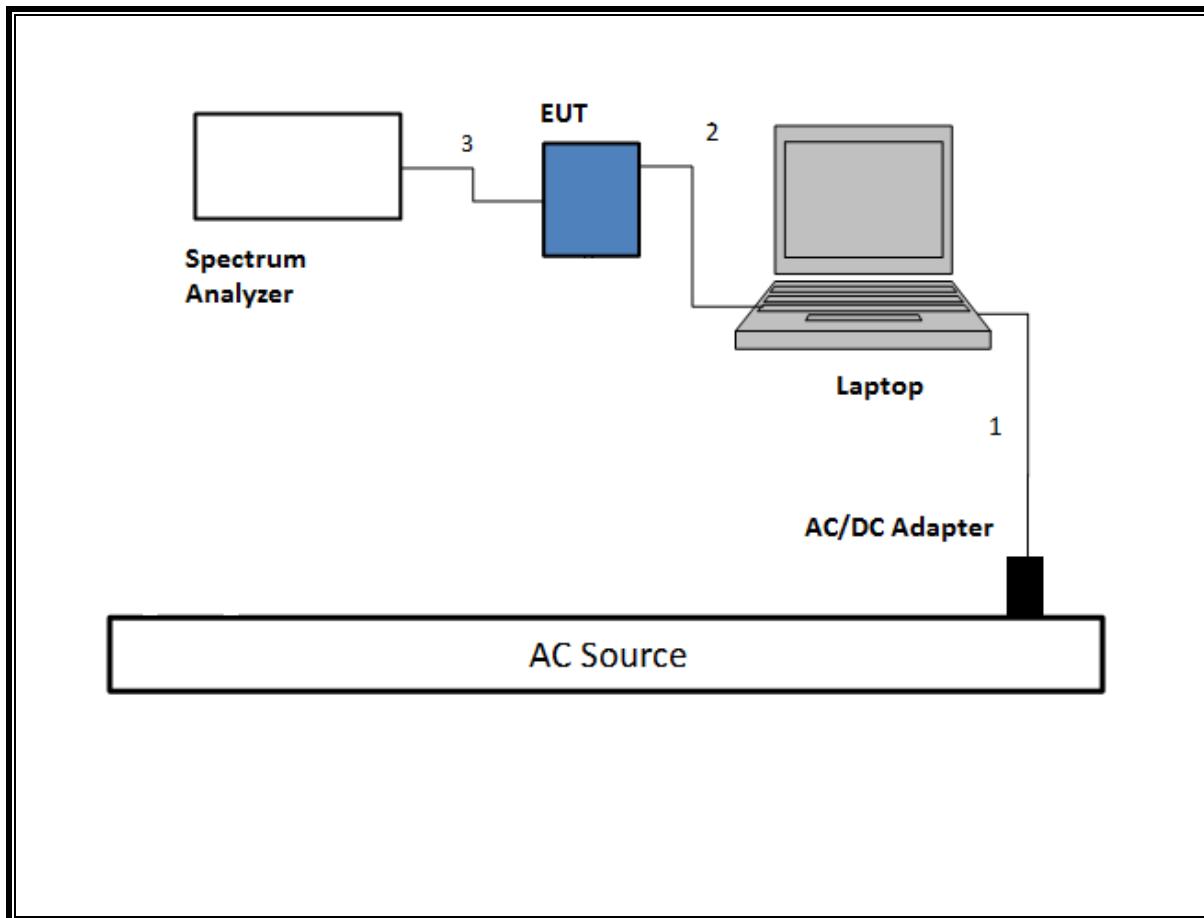
### I/O CABLES (BELOW 1GHz AND AC POWER LINE TEST WITH ADAPTER AND LAPTOP)

| I/O Cable List |          |                |                |             |                  |         |
|----------------|----------|----------------|----------------|-------------|------------------|---------|
| Cable No       | Port     | # of identical | Connector Type | Cable Type  | Cable Length (m) | Remarks |
| 1              | AC       | 3              | AC             | Un-shielded | 2                | N/A     |
| 2              | USB      | 1              | USB-C          | Un-shielded | 1                | N/A     |
| 3              | Ethernet | 2              | RJ45           | Un-shielded | 2                | N/A     |

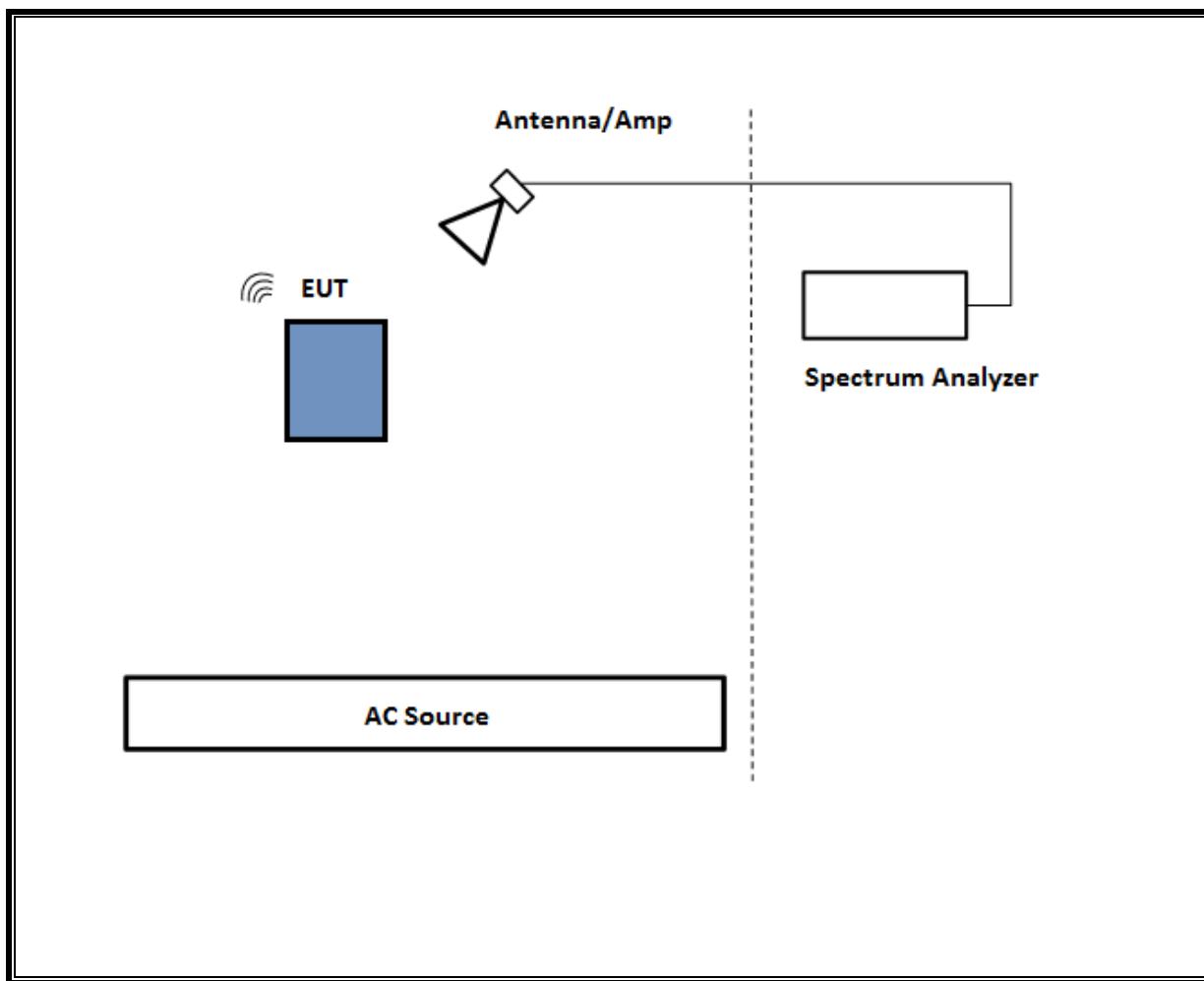
### TEST SETUP

The EUT is connected to a test laptop during the tests. Test software exercised the radio card.

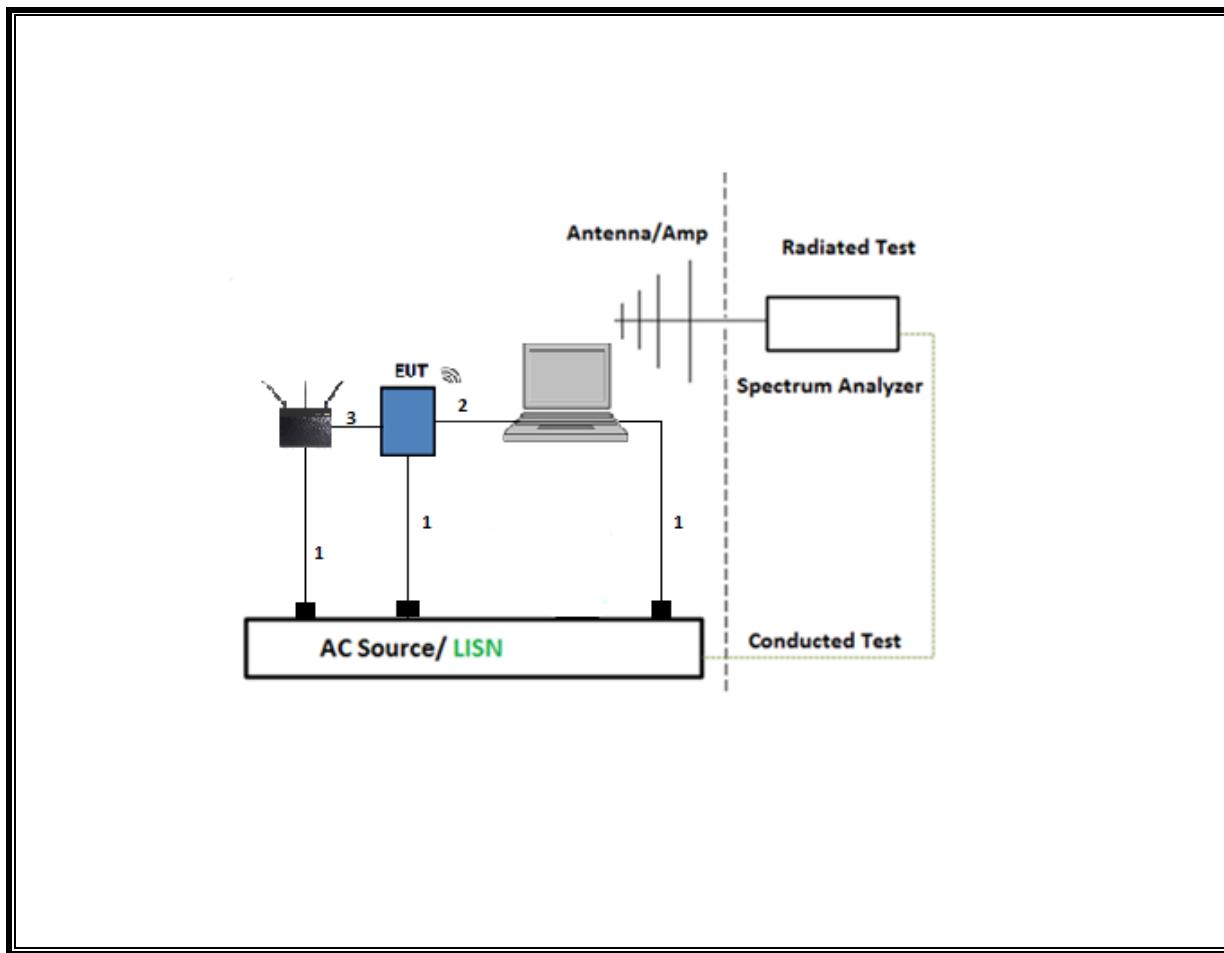
**SETUP DIAGRAM FOR CONDUCTED TESTS**



**SETUP DIAGRAM FOR RADIATED TESTS ABOVE 1 GHz**



**SETUP DIAGRAM FOR BELOW 1GHz and AC LINE CONDUCTED TEST**



## 7. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

| TEST EQUIPMENT LIST                                      |                                 |                        |            |            |            |
|--|---------------------------------|------------------------|------------|------------|------------|
| Description  | Manufacturer                    | Model                  | ID Num     | Last Cal   | Cal Due    |
| Spectrum Analyzer, PXA 3Hz to 44GHz                      | Keysight                        | N9030A                 | T339       | 01/21/2020 | 01/21/2021 |
| *Amplifier, 9KHz to 1GHz, 32dB                           | SONOMA INSTRUMENT               | 310                    | PRE0180176 | 04/03/2019 | 04/03/2020 |
| Antenna, Broadband Hybrid, 30MHz to 2000MHz              | Sunol Sciences Corp.            | JB3                    | T408       | 08/23/2019 | 08/23/2020 |
| Antenna, Double Ridge Guide Horn Antenna 700MHz to 18GHz | A.H. SYSTEMS, INC.              | SAS-571                | PRE0194893 | 05/16/2019 | 05/16/2020 |
| Amplifier, 1-18GHz                                       | Miteq Inc.                      | AFS42-00101800-25-S-42 | T931       | 05/11/2019 | 05/11/2020 |
| Antenna, Horn 1-18GHz                                    | ETS Lindgren                    | 3117                   | T712       | 03/09/2020 | 03/09/2021 |
| Amplifier, 1 to 18GHz, 35dB                              | AMPLICAL                        | AMP1G18-35             | 138301     | 01/14/2020 | 01/14/2021 |
| Spectrum Analyzer, PXA, 3Hz to 44GHz                     | Keysight Technologies Inc.      | N9030A                 | T1466      | 01/23/2020 | 01/23/2021 |
| *Antenna, Horn 1-18GHz                                   | ETS-Lindgren                    | 3117                   | T119       | 03/22/2019 | 03/22/2020 |
| Amplifier, 1 to 18GHz                                    | Miteq                           | AFS42-00101800-25-S-42 | T740       | 07/31/2019 | 07/31/2020 |
| Antenna, Horn 18 to 26.5GHz                              | ARA                             | MWH-1826/B             | T447       | 08/13/2019 | 08/13/2020 |
| *Pre-Amp 18-26GHz  | Agilent Technology              | 8449B                  | T404       | 03/23/2019 | 03/23/2020 |
| Spectrum Analyzer, PXA, 3Hz to 44GHz                     | Agilent (Keysight) Technologies | N9030A                 | T340       | 01/22/2020 | 01/22/2021 |
| Antenna, Active Loop 9KHz to 30MHz                       | ETS-Lindgren                    | 6502                   | T1616      | 10/28/2019 | 10/28/2020 |
| *Power Meter, P-series single channel                    | Keysight                        | N1911A                 | T1268      | 01/31/2019 | 01/31/2020 |
| *Power Sensor  | Keysight                        | N1921A                 | T1225      | 03/01/2019 | 03/01/2020 |
| Power Meter, P-series single channel                     | Keysight                        | N1911A                 | PRE0177682 | 01/21/2020 | 01/21/2021 |
| Power Sensor   | Keysight                        | N1921A                 | T1226      | 02/13/2020 | 02/13/2021 |

### AC Line Conducted

| Description                           | Manufacturer                  | Model                   | ID Num | Last Cal   | Cal Due    |
|---------------------------------------|-------------------------------|-------------------------|--------|------------|------------|
| *EMI Test Receiver 9kHz-7GHz          | Rohde & Schwarz               | ESR                     | T1436  | 04/10/2019 | 04/10/2020 |
| Power Cable, Line Conducted Emissions | UL                            | PR1                     | T861   | 10/27/2019 | 10/27/2020 |
| LISN for Conducted Emissions CISPR-16 | FISCHER CUSTOM COMMUNICATIONS | FCC-LISN-50/250-25-2-01 | T1310  | 01/23/2020 | 01/23/2021 |

### UL AUTOMATION SOFTWARE

|                            |    |        |                            |
|----------------------------|----|--------|----------------------------|
| Radiated Software          | UL | UL EMC | Ver 9.5, Mar 6, 2020       |
| Conducted Software         | UL | UL EMC | 2020.2.26                  |
| AC Line Conducted Software | UL | UL EMC | Ver 9.5, February 21, 2020 |

\*Testing was performed after Calibration was completed.

## 8. MEASUREMENT METHOD

On Time and Duty Cycle: ANSI C63.10-2013 Section 11.6

6 dB BW: ANSI C63.10 Subclause -11.8.1 RBW  $\geq$  DTS BW

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

Output Power: ANSI C63.10 Subclause -11.9.1.3 Method PKPM1 Peak-reading power meter

Output Power: ANSI C63.10 Subclause -11.9.2.3.2 Measurement using gated average power Meter

PSD: ANSI C63.10 Subclause -11.10.2 Method PKPSD (peak PSD)

Radiated emissions non-restricted frequency bands: ANSI C63.10 Subclause -11.11

Radiated emissions restricted frequency bands: ANSI C63.10 Subclause -11.12.1

Conducted emissions in restricted frequency bands: ANSI C63.10 Subclause -11.12.2

Band-edge: ANSI C63.10 Subclause -11.13.3.2 Integration method -Peak detection

Band-edge: ANSI C63.10 Subclause -11.13.3.3 Integration method -Trace averaging with continuous transmission at full power

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2.

Radiated Spurious Emissions Below 30MHz: ANSI C63.10-2013 Section 6.4

## 9. ANTENNA PORT TEST RESULTS

### 9.1. ON TIME AND DUTY CYCLE

#### LIMITS

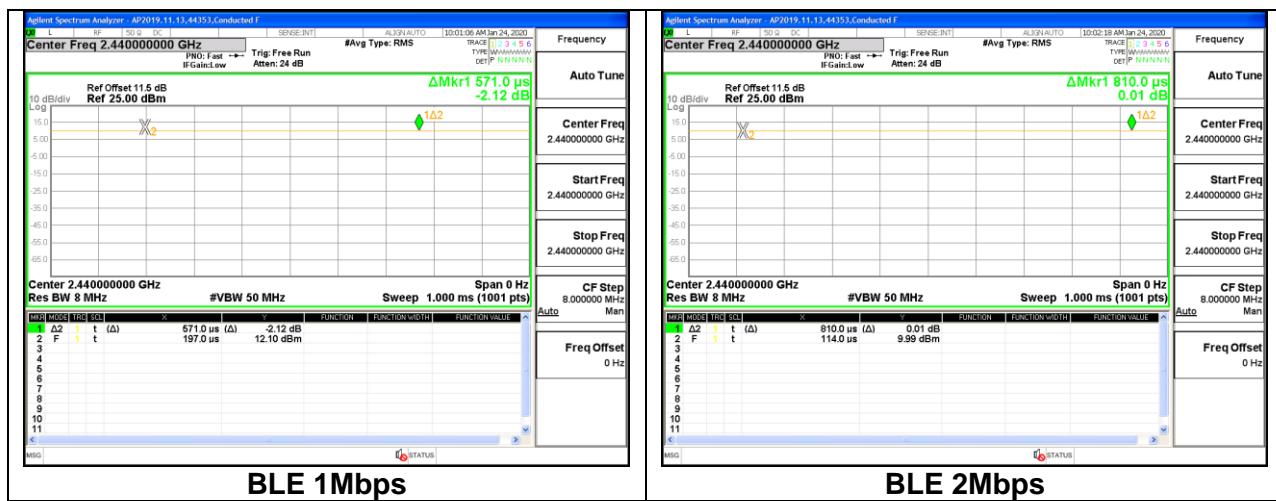
None; for reporting purposes only.

#### PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

#### ON TIME AND DUTY CYCLE RESULTS

| Mode               | ON Time B (msec) | Period (msec) | Duty Cycle x (linear) | Duty Cycle (%) | Duty Cycle Correction Factor (dB) | 1/B Minimum VBW (kHz) |
|--------------------|------------------|---------------|-----------------------|----------------|-----------------------------------|-----------------------|
| <b>2.4GHz Band</b> |                  |               |                       |                |                                   |                       |
| BLE, 1M            | 0.571            | 0.571         | 1.000                 | 100.00%        | 0.00                              | 0.010                 |
| BLE, 2M            | 0.810            | 0.810         | 1.000                 | 100.00%        | 0.00                              | 0.010                 |



## 9.2. 99% BANDWIDTH

### LIMITS

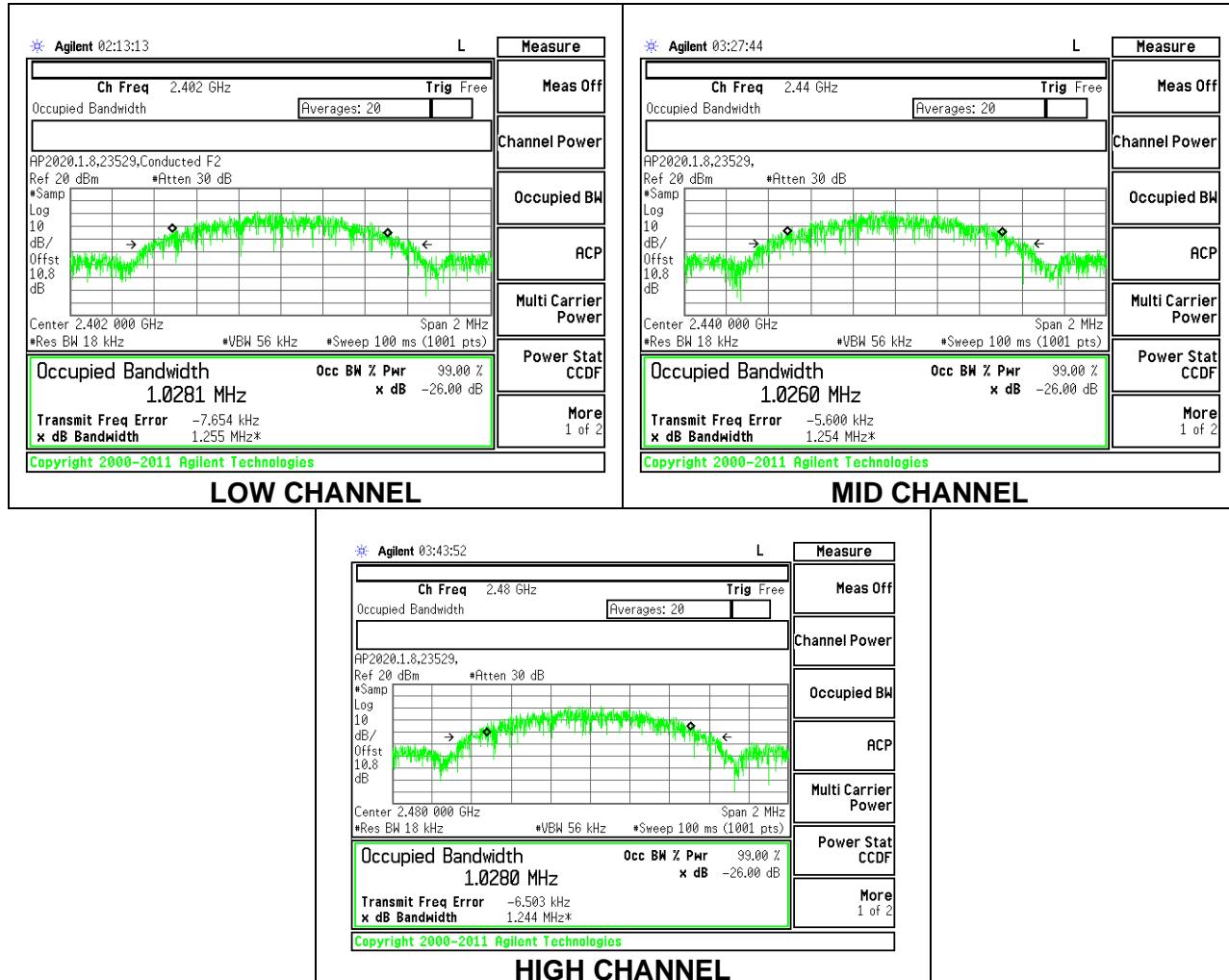
None; for reporting purposes only.

### RESULTS

|     |       |       |            |
|-----|-------|-------|------------|
| ID: | 23529 | Date: | 01/23/2020 |
|-----|-------|-------|------------|

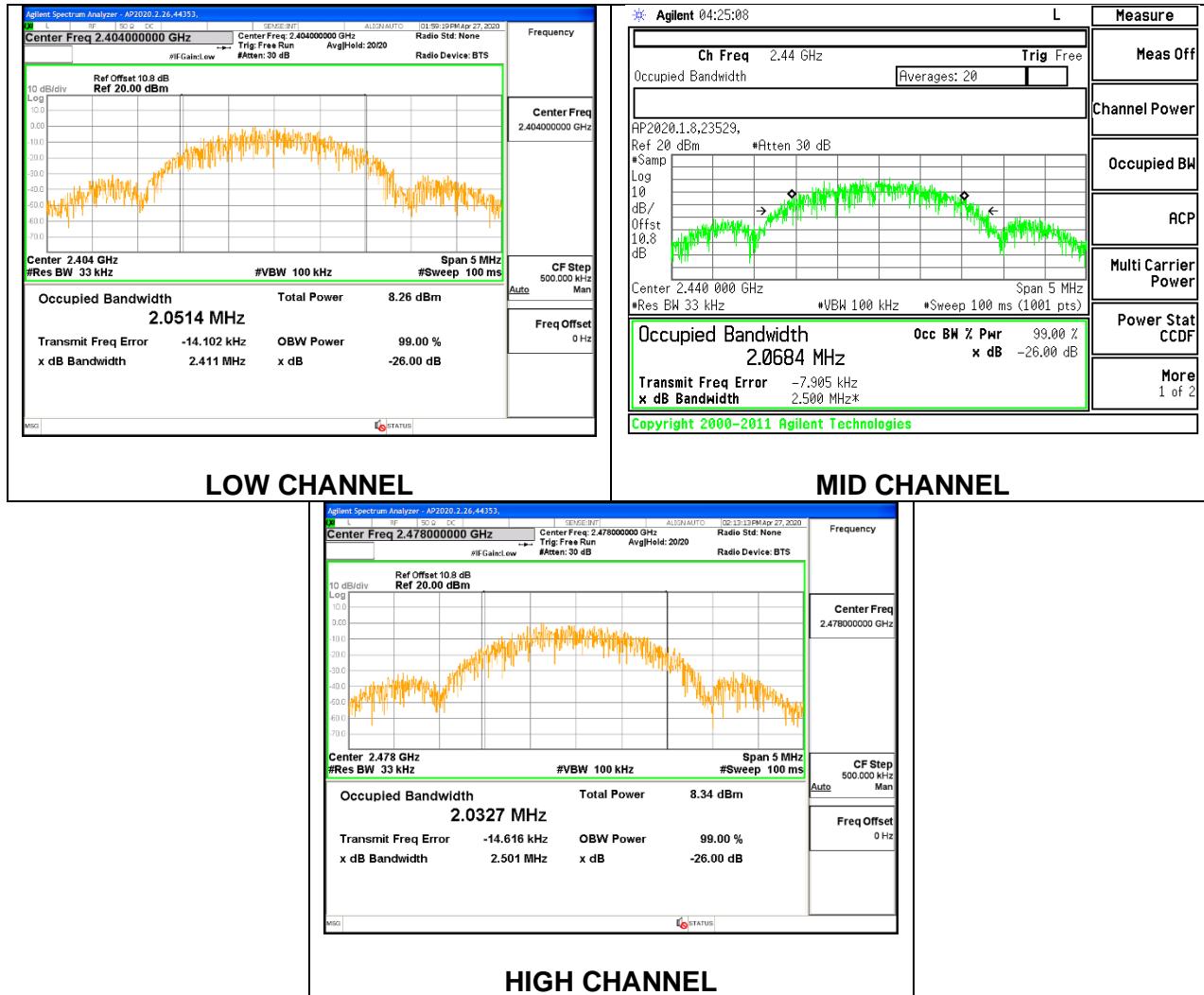
#### 9.2.1. BLE (1Mbps)

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|-----------------|---------------------|
| Low     | 2402            | 1.0281              |
| Middle  | 2440            | 1.0260              |
| High    | 2480            | 1.0280              |



### 9.2.2. BLE (2Mbps)

| Channel | Frequency (MHz) | 99% Bandwidth (MHz) |
|---------|-----------------|---------------------|
| Low     | 2404            | 2.0514              |
| Middle  | 2440            | 2.0684              |
| High    | 2478            | 2.0327              |



### 9.3. 6 dB BANDWIDTH

#### LIMITS

FCC §15.247 (a) (2)

RSS-247 5.2 (a)

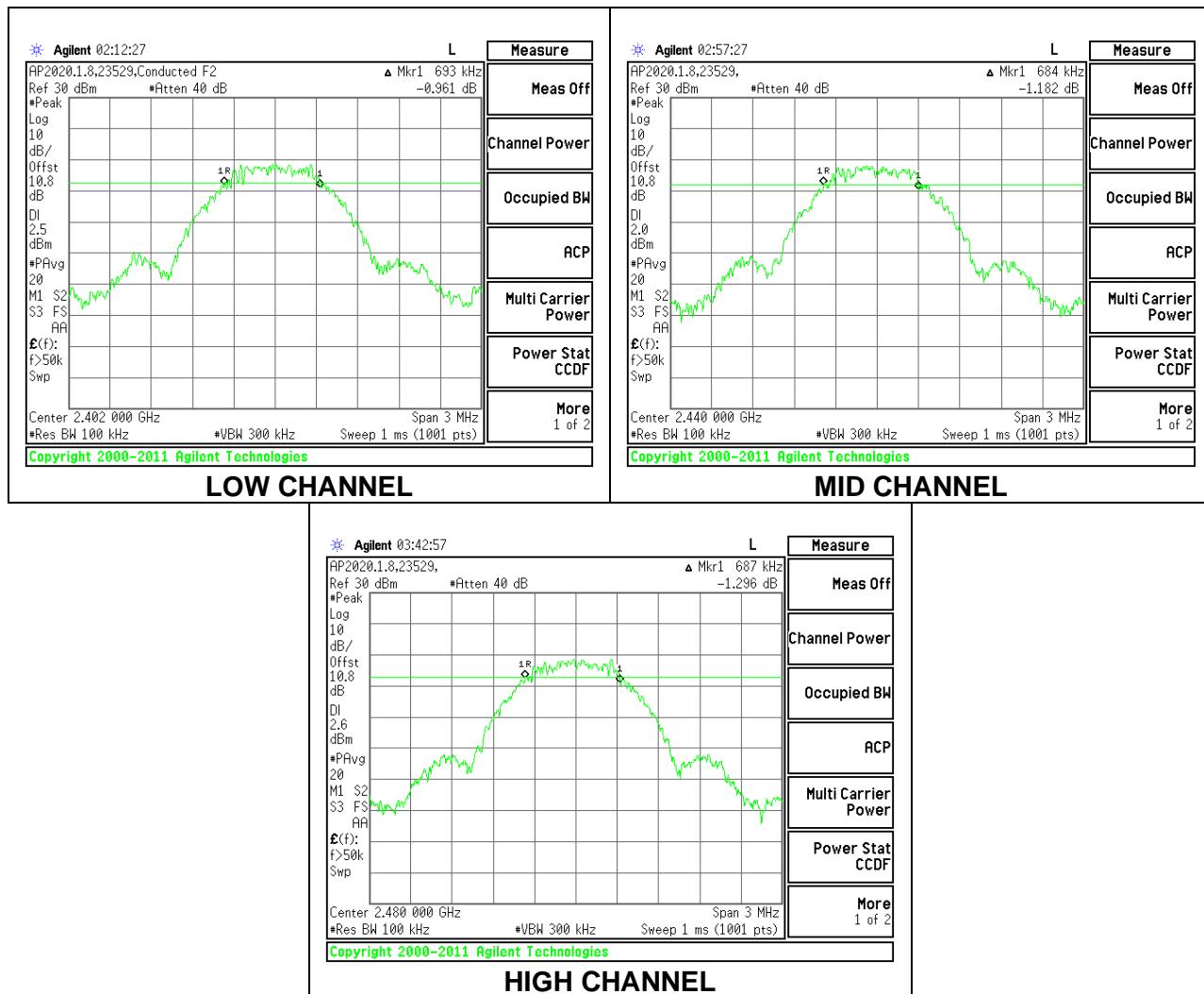
The minimum 6 dB bandwidth shall be at least 500 kHz.

#### RESULTS

|            |       |              |            |
|------------|-------|--------------|------------|
| <b>ID:</b> | 23529 | <b>Date:</b> | 01/23/2020 |
|------------|-------|--------------|------------|

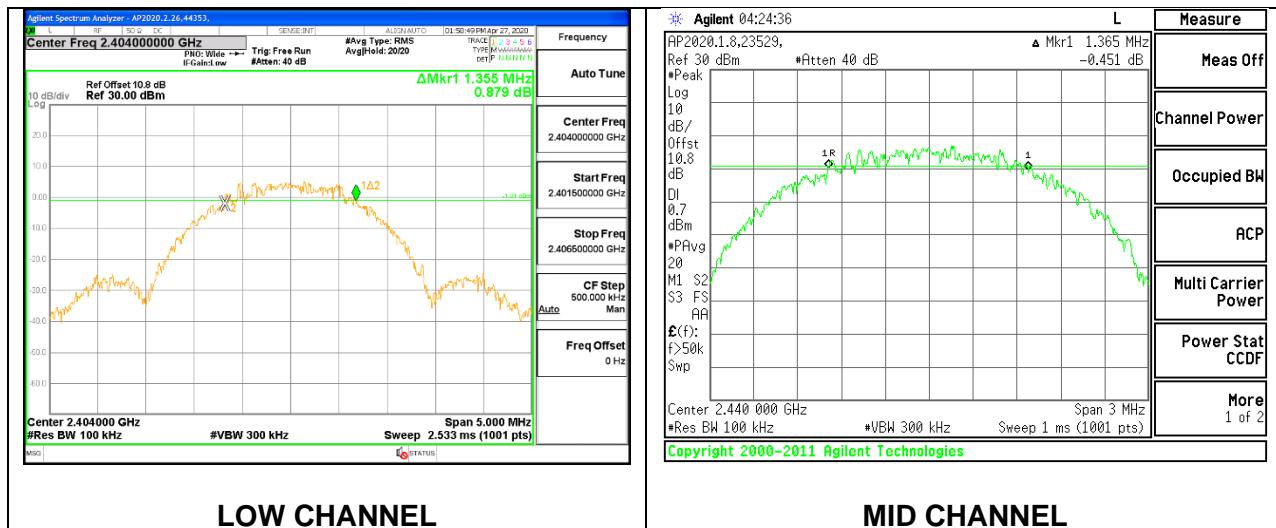
### 9.3.1. BLE (1Mbps)

| Channel | Frequency (MHz) | 6 dB Bandwidth (MHz) | Minimum Limit (MHz) |
|---------|-----------------|----------------------|---------------------|
| Low     | 2402            | 0.693                | 0.5                 |
| Middle  | 2440            | 0.684                | 0.5                 |
| High    | 2480            | 0.687                | 0.5                 |



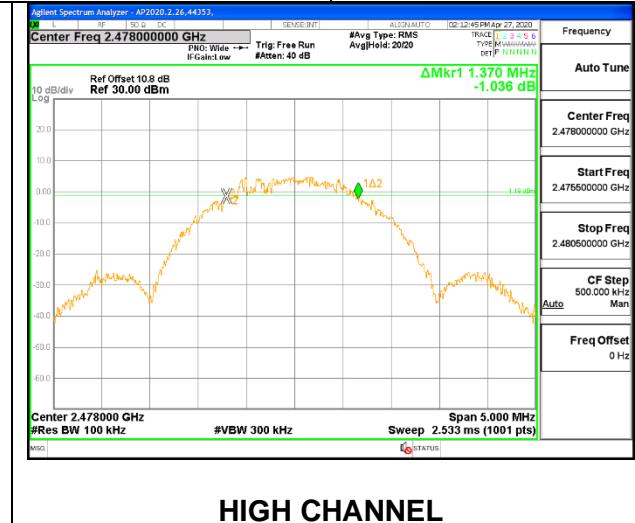
### 9.3.2. BLE (2Mbps)

| Channel | Frequency (MHz) | 6 dB Bandwidth (MHz) | Minimum Limit (MHz) |
|---------|-----------------|----------------------|---------------------|
| Low     | 2404            | 1.355                | 0.5                 |
| Middle  | 2440            | 1.365                | 0.5                 |
| High    | 2478            | 1.370                | 0.5                 |



LOW CHANNEL

MID CHANNEL



## 9.4. OUTPUT POWER

### LIMITS

FCC §15.247 (b) (3)

RSS-247 5.4 (d)

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

### TEST PROCEDURE

The transmitter output is connected to a power meter with wideband power sensor.

The cable assembly insertion loss of 10.8 dB (including 10 dB pad and 0.8 dB cable) was entered as an offset in the power meter to allow for a gated average reading of power.

### RESULTS

#### 9.4.1. BLE (1Mbps)

|            |           |
|------------|-----------|
| Tested By: | 44366     |
| Date:      | 1/24/2020 |

| Channel | Frequency<br>(MHz) | Peak Power<br>Reading<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|---------|--------------------|--------------------------------|----------------|----------------|
| Low     | 2402               | 7.26                           | 30             | -22.74         |
| Middle  | 2440               | 7.21                           | 30             | -22.79         |
| High    | 2480               | 7.25                           | 30             | -22.75         |

#### 9.4.2. BLE (2Mbps)

|            |           |
|------------|-----------|
| Tested By: | 44353     |
| Date:      | 4/27/2020 |

| Channel | Frequency<br>(MHz) | Peak Power<br>Reading<br>(dBm) | Limit<br>(dBm) | Margin<br>(dB) |
|---------|--------------------|--------------------------------|----------------|----------------|
| Low     | 2404               | 7.24                           | 30             | -22.76         |
| Middle  | 2440               | 7.20                           | 30             | -22.80         |
| High    | 2478               | 7.23                           | 30             | -22.77         |

## 9.5. AVERAGE POWER

### LIMITS

None; for reporting purposes only.

### TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.8 dB (including 10 dB pad and 0.8 dB cable) was entered as an offset in the power meter to allow for a gated average reading of power.

### RESULTS

### 9.5.1. BLE (1Mbps)

|            |           |
|------------|-----------|
| Tested By: | 44366     |
| Date:      | 1/24/2020 |

| Channel | Frequency<br>(MHz) | AV power<br>(dBm) |
|---------|--------------------|-------------------|
| Low     | 2402               | 6.91              |
| Middle  | 2440               | 6.87              |
| High    | 2480               | 6.90              |

### 9.5.2. BLE (2Mbps)

|            |           |
|------------|-----------|
| Tested By: | 44353     |
| Date:      | 4/27/2020 |

| Channel | Frequency<br>(MHz) | AV power<br>(dBm) |
|---------|--------------------|-------------------|
| Low     | 2404               | 6.90              |
| Middle  | 2440               | 6.85              |
| High    | 2478               | 6.88              |

## 9.6. POWER SPECTRAL DENSITY

### LIMITS

FCC §15.247 (e)

RSS-247 (5.2) (b)

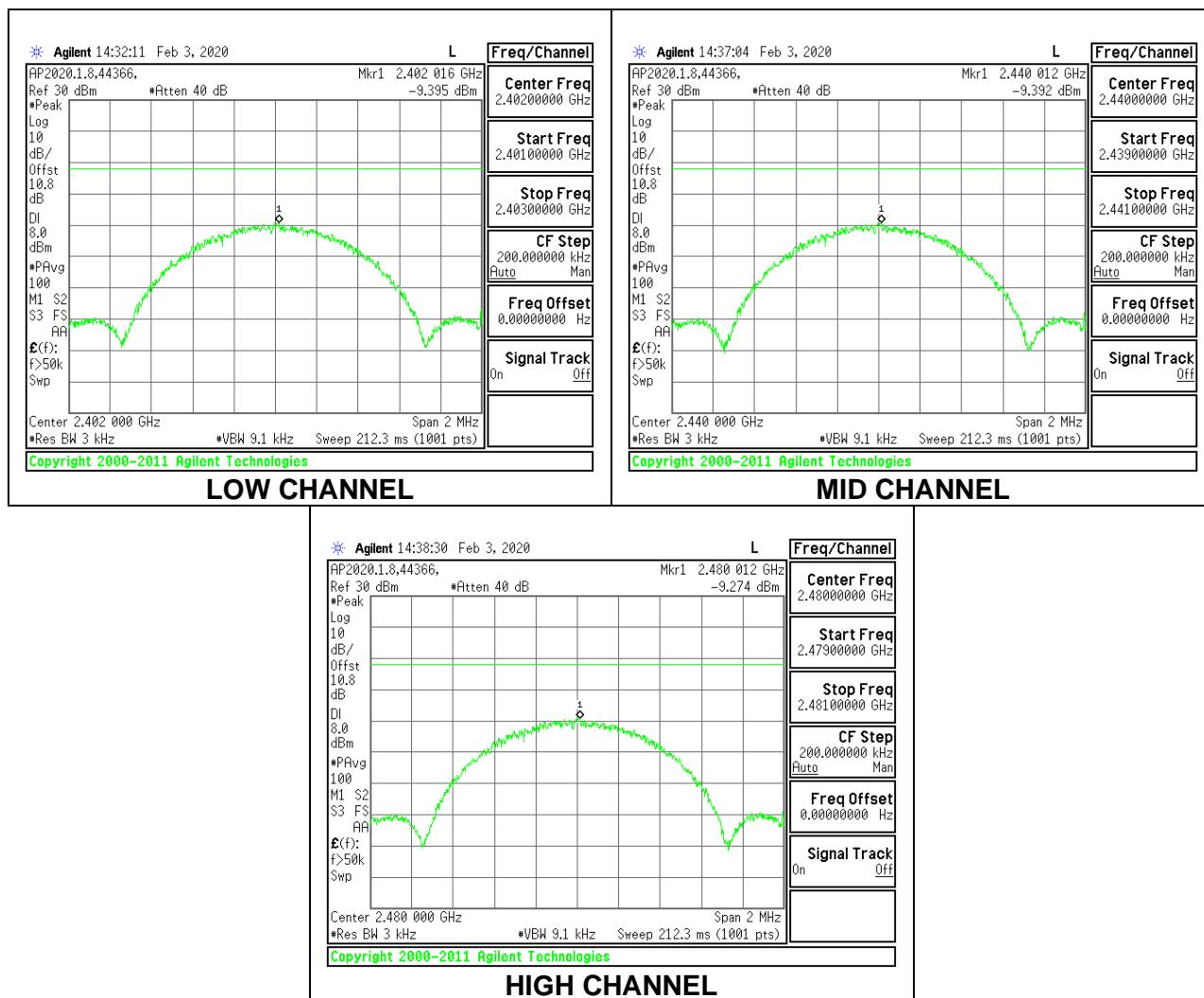
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### RESULTS

|     |       |       |            |
|-----|-------|-------|------------|
| ID: | 23529 | Date: | 01/23/2020 |
|-----|-------|-------|------------|

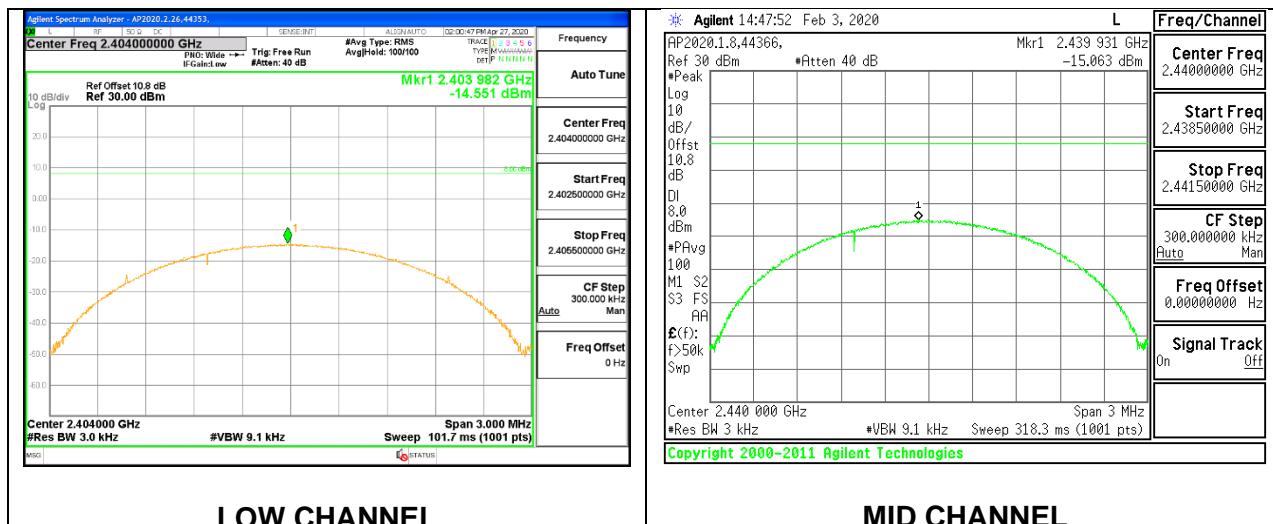
### 9.6.1. BLE (1Mbps)

| Channel | Frequency (MHz) | PSD (dBm/3kHz) | Limit (dBm/3kHz) | Margin (dB) |
|---------|-----------------|----------------|------------------|-------------|
| Low     | 2402            | -9.395         | 8                | -17.40      |
| Middle  | 2440            | -9.392         | 8                | -17.39      |
| High    | 2480            | -9.274         | 8                | -17.27      |



### 9.6.2. BLE (2Mbps)

| Channel | Frequency (MHz) | PSD (dBm/3kHz) | Limit (dBm/3kHz) | Margin (dB) |
|---------|-----------------|----------------|------------------|-------------|
| Low     | 2404            | -14.551        | 8                | -22.55      |
| Middle  | 2440            | -15.063        | 8                | -23.06      |
| High    | 2478            | -14.809        | 8                | -22.81      |



## 9.7. CONDUCTED SPURIOUS EMISSIONS

### LIMITS

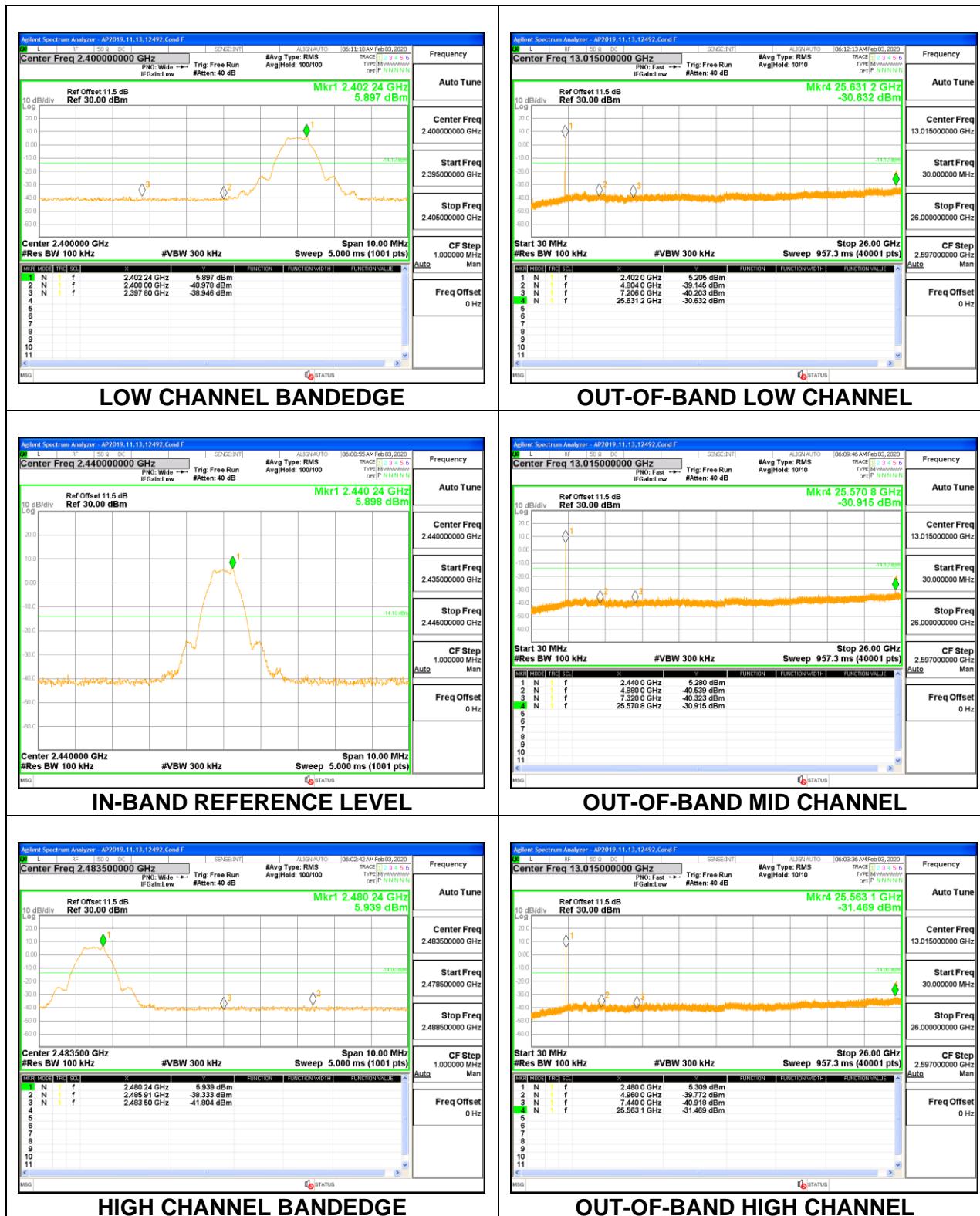
FCC §15.247 (d)

RSS-247 5.5

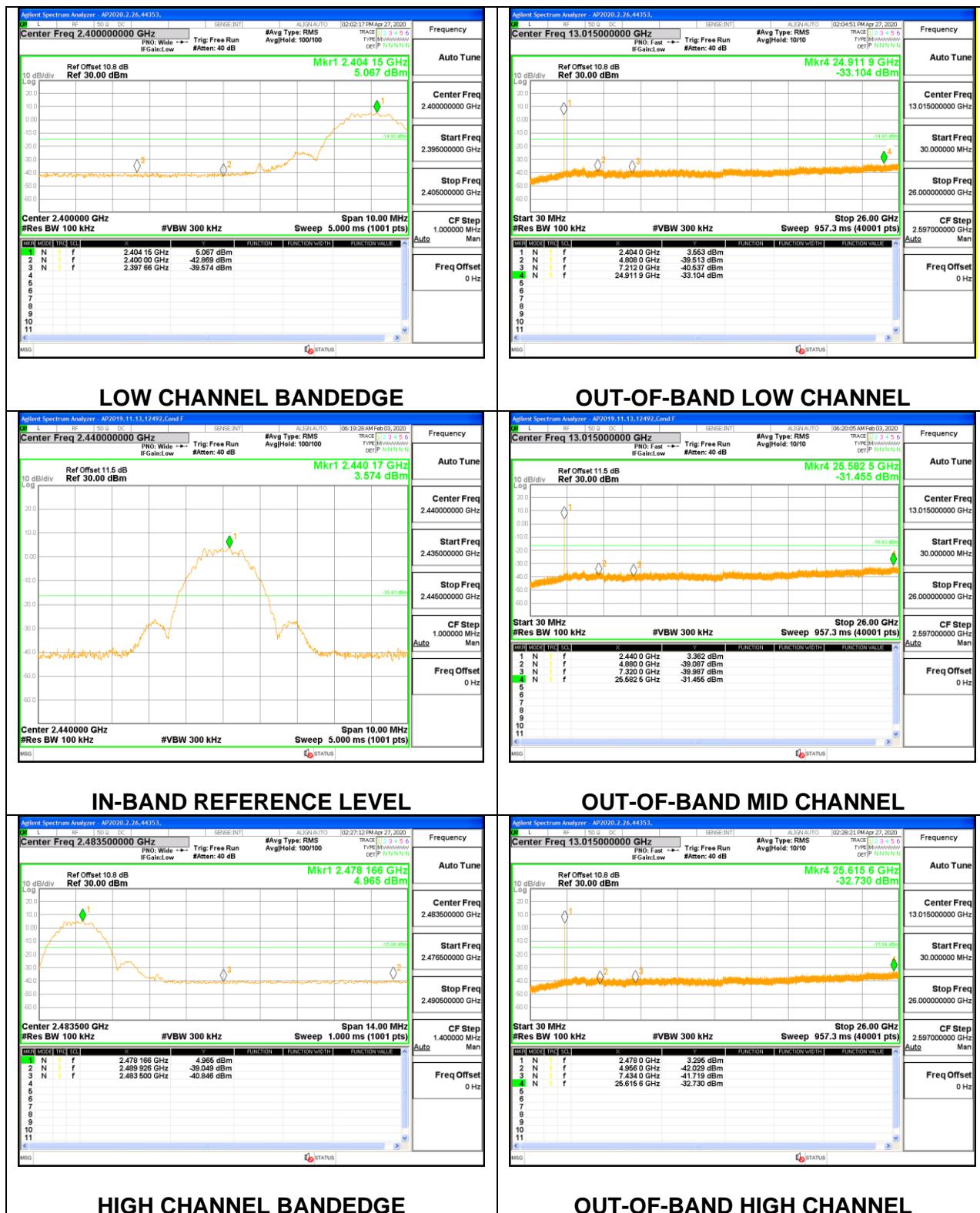
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

### RESULTS

### 9.7.1. BLE (1Mbps)



## 9.7.2. BLE (2Mbps)



## 10. RADIATED TEST RESULTS

### 10.1. LIMITS AND PROCEDURE

#### LIMITS

FCC §15.205 and §15.209

RSS-GEN, Section 8.9 and 8.10.

| Frequency Range (MHz) | Field Strength Limit (uV/m) at 3 m | Field Strength Limit (dBuV/m) at 3 m |
|-----------------------|------------------------------------|--------------------------------------|
| 0.009-0.490           | 2400/F(kHz) @ 300 m                | -                                    |
| 0.490-1.705           | 24000/F(kHz) @ 30 m                | -                                    |
| 1.705 - 30            | 30 @ 30m                           | -                                    |
| 30 - 88               | 100                                | 40                                   |
| 88 - 216              | 150                                | 43.5                                 |
| 216 - 960             | 200                                | 46                                   |
| Above 960             | 500                                | 54                                   |

#### TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and as applicable for average measurements.

The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel)

**KDB 414788 Open Field Site(OFS) and Chamber Correlation Justification**

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

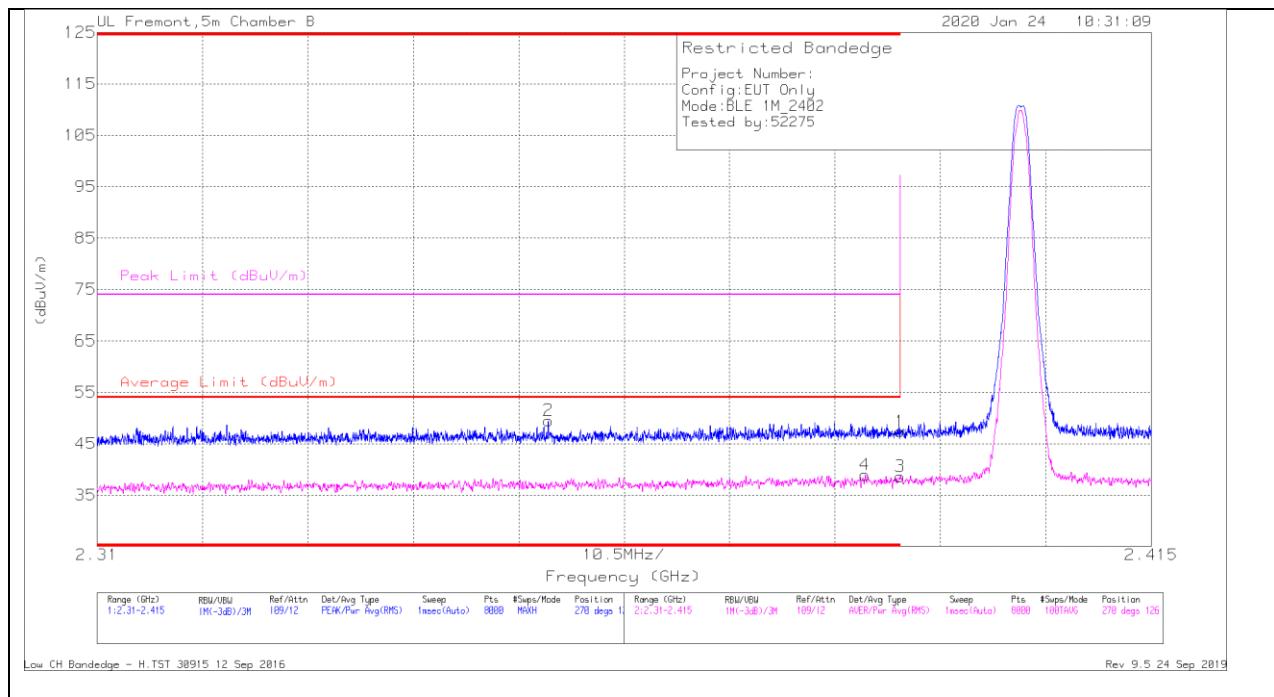
OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result

## 10.2. TRANSMITTER ABOVE 1 GHz

### 10.2.1. BLE (1Mbps)

#### BANDEDGE (LOW CHANNEL)

#### HORIZONTAL RESULT



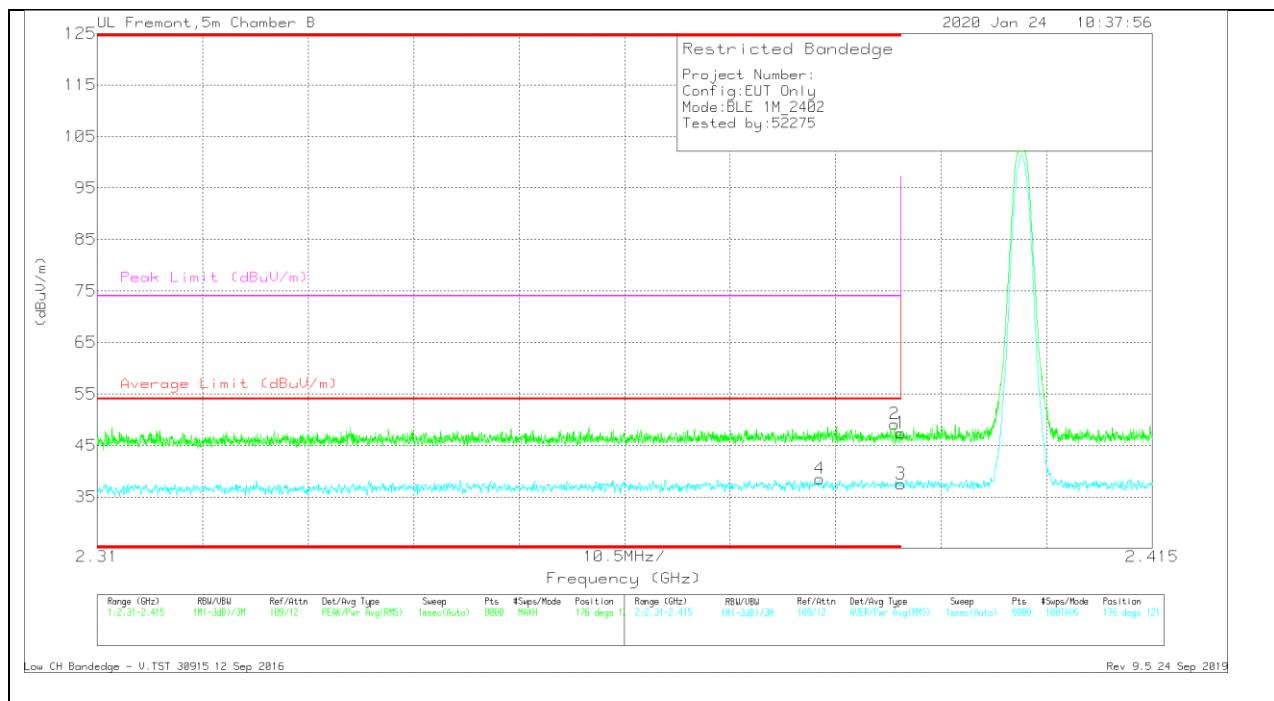
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF PRE01 94893 (dB/m) | Amp/C bl/Fitr/ Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|-----------------------|-------------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.39          | 35.96                | Pk  | 30.3                  | -18.9                   | 47.36                      | -                      | -           | 74                  | -26.64         | 270            | 126         | H        |
| 2      | * 2.35495       | 38.41                | Pk  | 30.1                  | -19                     | 49.51                      | -                      | -           | 74                  | -24.49         | 270            | 126         | H        |
| 3      | * 2.39          | 27.24                | RMS | 30.3                  | -18.9                   | 38.64                      | 54                     | -15.36      | -                   | -              | 270            | 126         | H        |
| 4      | * 2.3865        | 27.62                | RMS | 30.2                  | -18.9                   | 38.92                      | 54                     | -15.08      | -                   | -              | 270            | 126         | H        |

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

## VERTICAL RESULT



| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF PRE01 94893 (dB/m) | Amp/C bl/Fitr/ Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|-----------------------|-------------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.39          | 36.04                | Pk  | 30.3                  | -18.9                   | 47.44                      | -                      | -           | 74                  | -26.56         | 176            | 121         | V        |
| 2      | * 2.38935       | 37.76                | Pk  | 30.3                  | -18.9                   | 49.16                      | -                      | -           | 74                  | -24.84         | 176            | 121         | V        |
| 3      | * 2.39          | 26.15                | RMS | 30.3                  | -18.9                   | 37.55                      | 54                     | -16.45      | -                   | -              | 176            | 121         | V        |
| 4      | * 2.38191       | 27.14                | RMS | 30.2                  | -18.8                   | 38.54                      | 54                     | -15.46      | -                   | -              | 176            | 121         | V        |

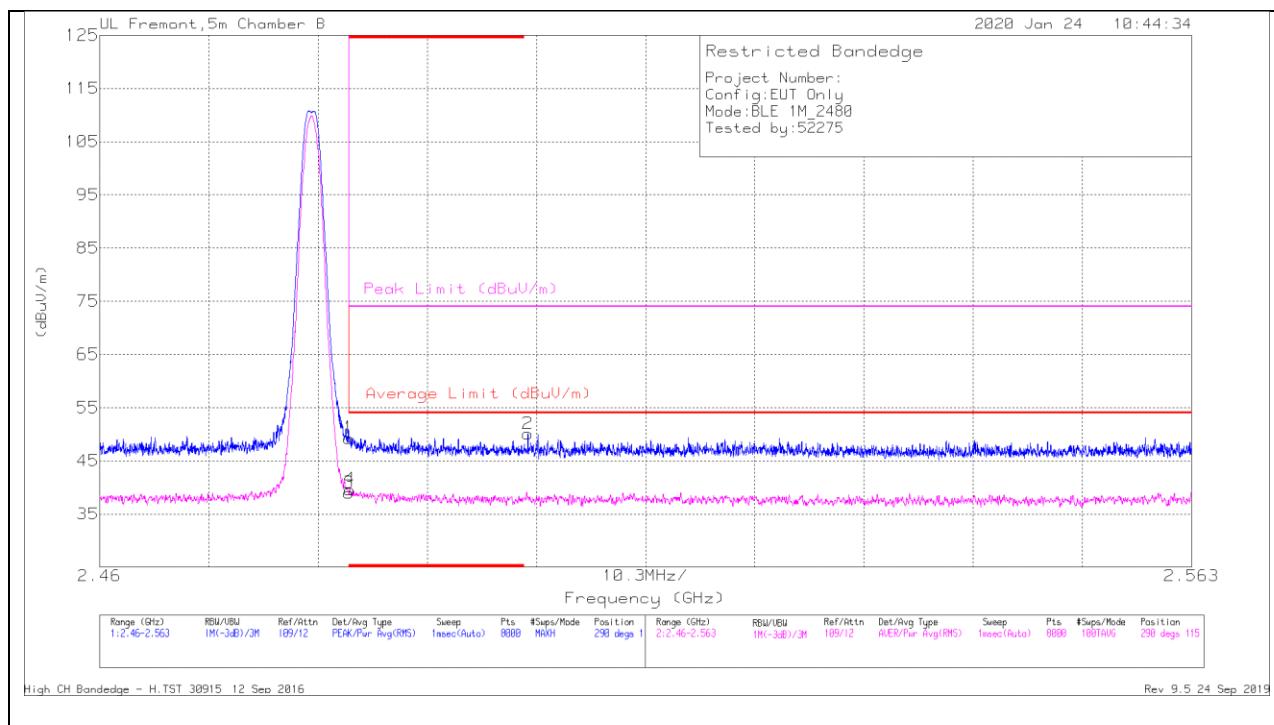
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK - Peak detector

RMS - RMS detection

## BANDEDGE (HIGH CHANNEL)

### HORIZONTAL RESULT



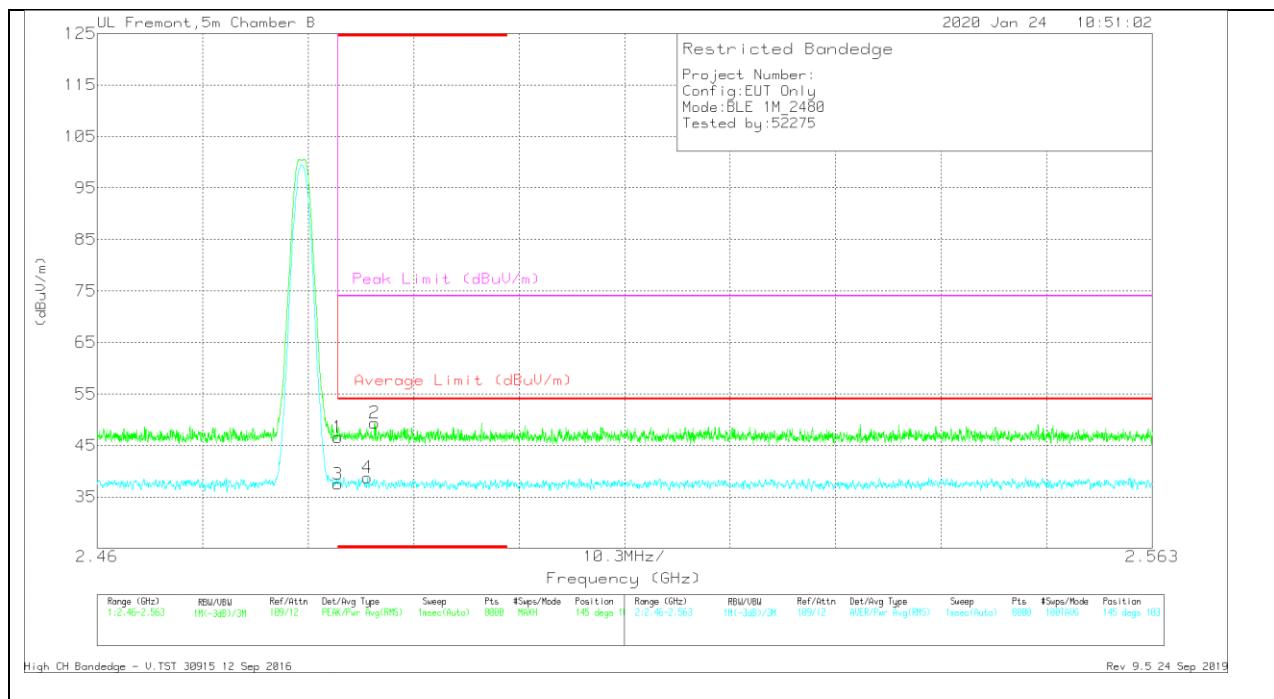
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF PRE01 94893 (dB/m) | Amp/C bl/Filtr/ Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|-----------------------|--------------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.4835        | 37.97                | Pk  | 30.2                  | -18.9                    | 49.27                      | -                      | -           | 74                  | -24.73         | 290            | 115         | H        |
| 3      | * 2.4835        | 27.64                | RMS | 30.2                  | -18.9                    | 38.94                      | 54                     | -15.06      | -                   | -              | 290            | 115         | H        |
| 4      | * 2.48359       | 28.32                | RMS | 30.2                  | -18.9                    | 39.62                      | 54                     | -14.38      | -                   | -              | 290            | 115         | H        |
| 2      | 2.5004          | 38.87                | Pk  | 30.1                  | -18.9                    | 50.07                      | -                      | -           | 74                  | -23.93         | 290            | 115         | H        |

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK - Peak detector

RMS - RMS detection

## VERTICAL RESULT



| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF PRE01 94893 (dB/m) | Amp/Cb I/Fitr/Pad (dB) | Corrected Reading (dBuV/m) | Average (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|-----------------------|------------------------|----------------------------|------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.4835        | 35.32                | Pk  | 30.2                  | -18.9                  | 46.62                      | -                | -           | 74                  | -27.38         | 145            | 103         | V        |
| 2      | * 2.48709       | 38.09                | Pk  | 30.2                  | -18.9                  | 49.39                      | -                | -           | 74                  | -24.61         | 145            | 103         | V        |
| 3      | * 2.4835        | 26.17                | RMS | 30.2                  | -18.9                  | 37.47                      | 54               | -16.53      | -                   | -              | 145            | 103         | V        |
| 4      | * 2.4864        | 27.45                | RMS | 30.2                  | -18.9                  | 38.75                      | 54               | -15.25      | -                   | -              | 145            | 103         | V        |

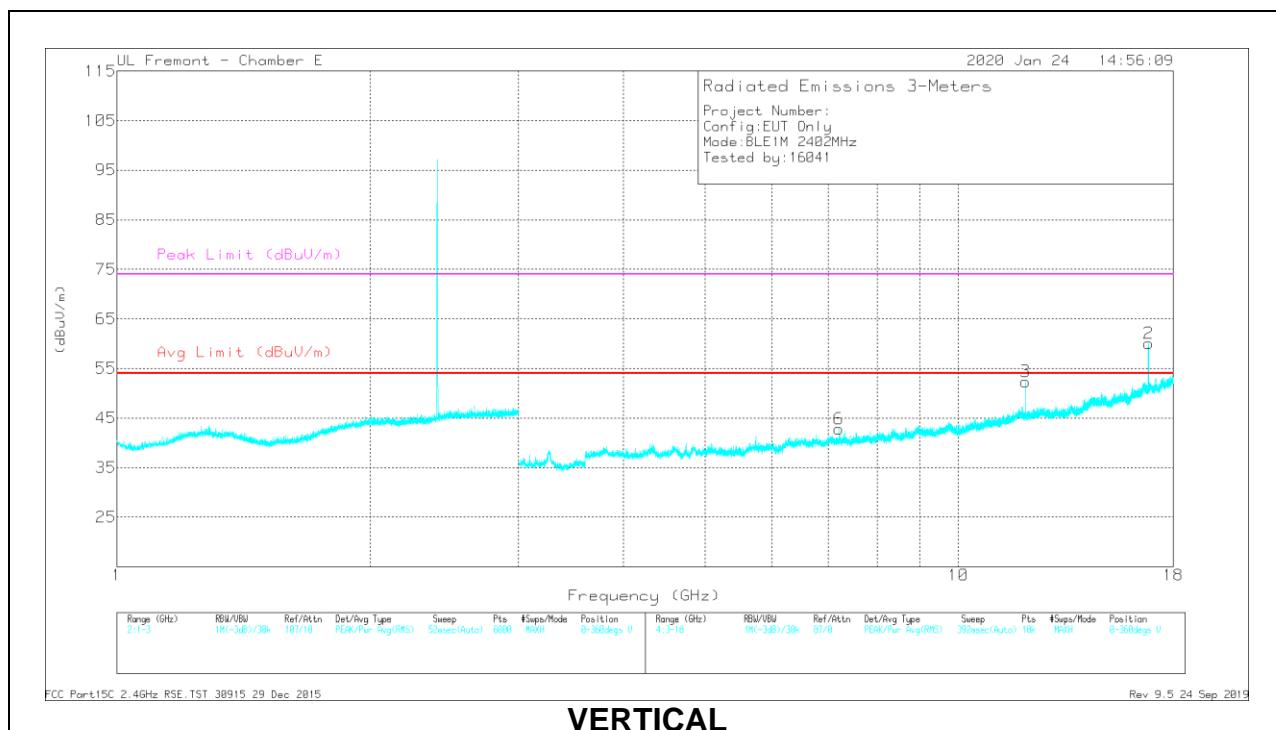
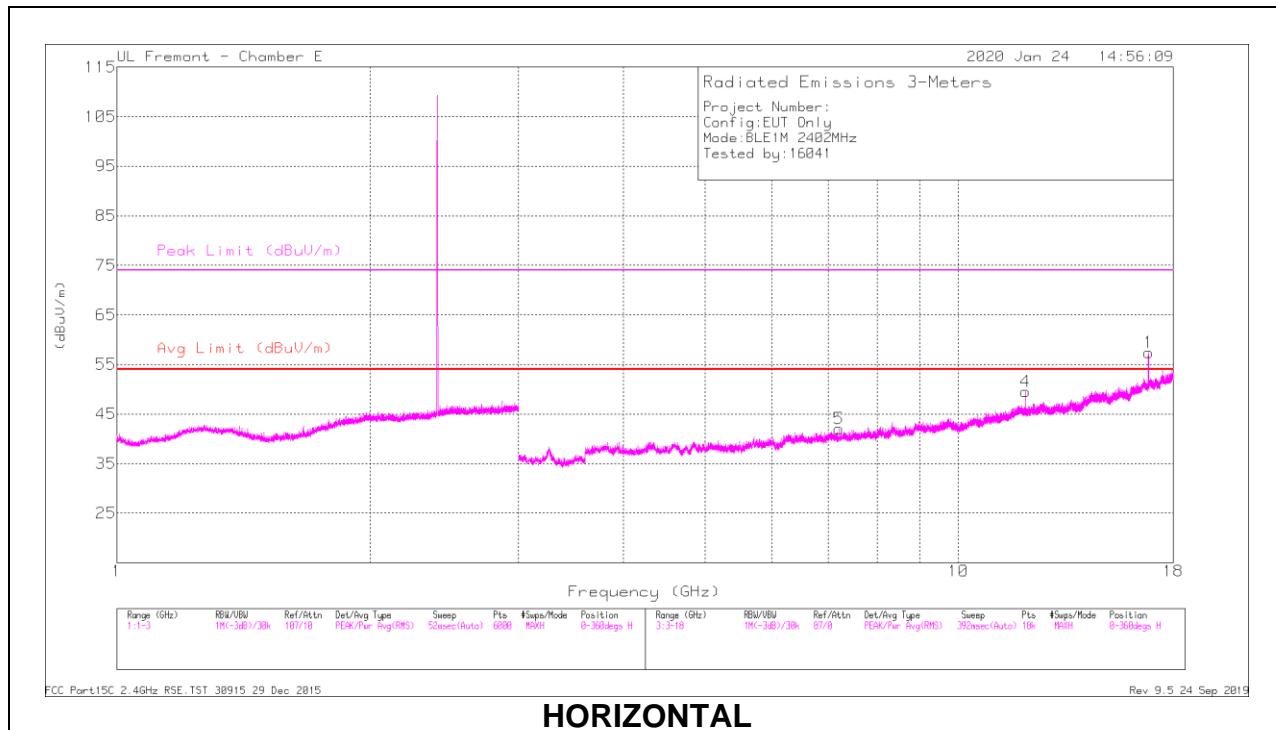
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK - Peak detector

RMS - RMS detection

## HARMONICS AND SPURIOUS EMISSIONS

### LOW CHANNEL RESULTS



## RADIATED EMISSIONS

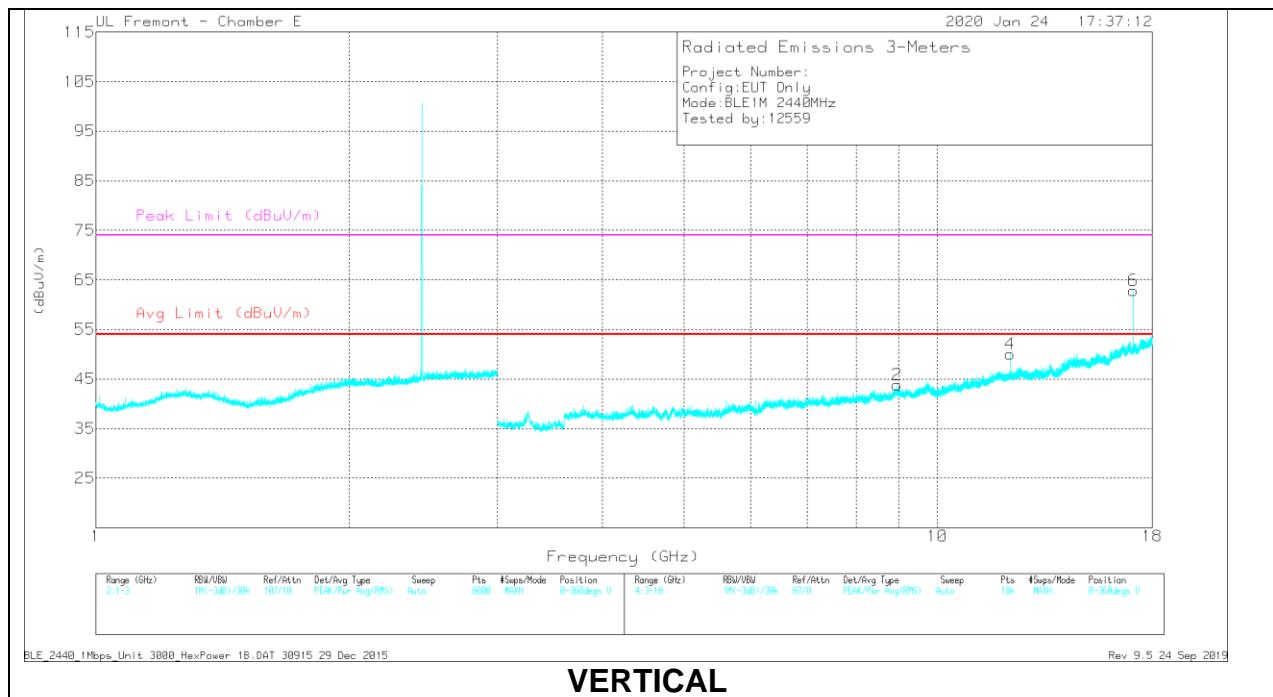
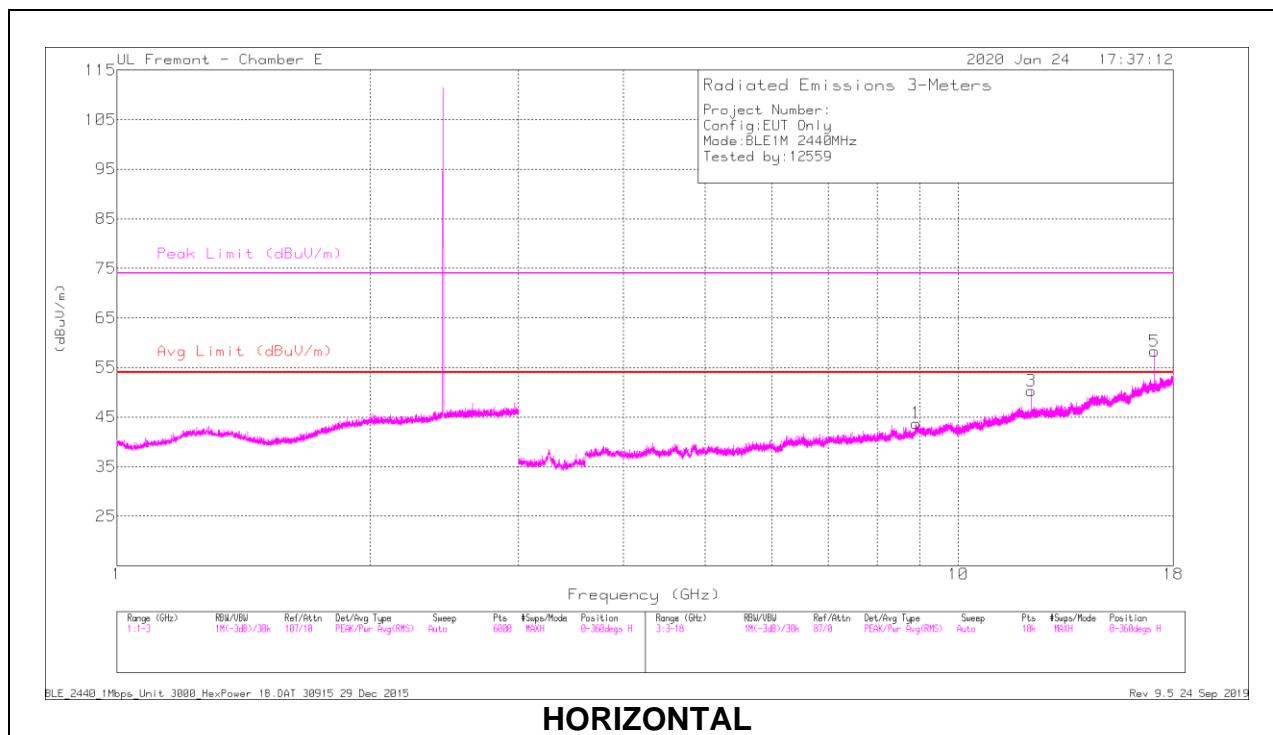
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det  | AF T119 (dB/m) | Amp/CbI/Flt/P ad (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|----------------|-----------------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 4      | * 12.01131      | 39.19                | PK2  | 39             | -21.8                 | 56.39                      | -                  | -           | 74                  | -17.61         | 220            | 262         | H        |
|        | * 12.00881      | 29.1                 | MAv1 | 39             | -21.8                 | 46.3                       | 54                 | -7.7        | -                   | -              | 220            | 262         | H        |
| 3      | * 12.01105      | 39.72                | PK2  | 39             | -21.8                 | 56.92                      | -                  | -           | 74                  | -17.08         | 253            | 210         | V        |
|        | * 12.0111       | 31                   | MAv1 | 39             | -21.8                 | 48.2                       | 54                 | -5.8        | -                   | -              | 253            | 210         | V        |
| 6      | 7.20561         | 41.67                | PK2  | 35.6           | -27.6                 | 49.67                      | -                  | -           | -                   | -              | 0              | 225         | V        |
| 5      | 7.20644         | 40.51                | PK2  | 35.6           | -27.6                 | 48.51                      | -                  | -           | -                   | -              | 164            | 122         | H        |
| 2      | 16.81203        | 40.44                | PK2  | 41.4           | -17.9                 | 63.94                      | -                  | -           | -                   | -              | 215            | 192         | V        |
| 1      | 16.8156         | 38.49                | PK2  | 41.4           | -17.9                 | 61.99                      | -                  | -           | -                   | -              | 252            | 105         | H        |

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

## MID CHANNEL RESULTS



## RADIATED EMISSIONS

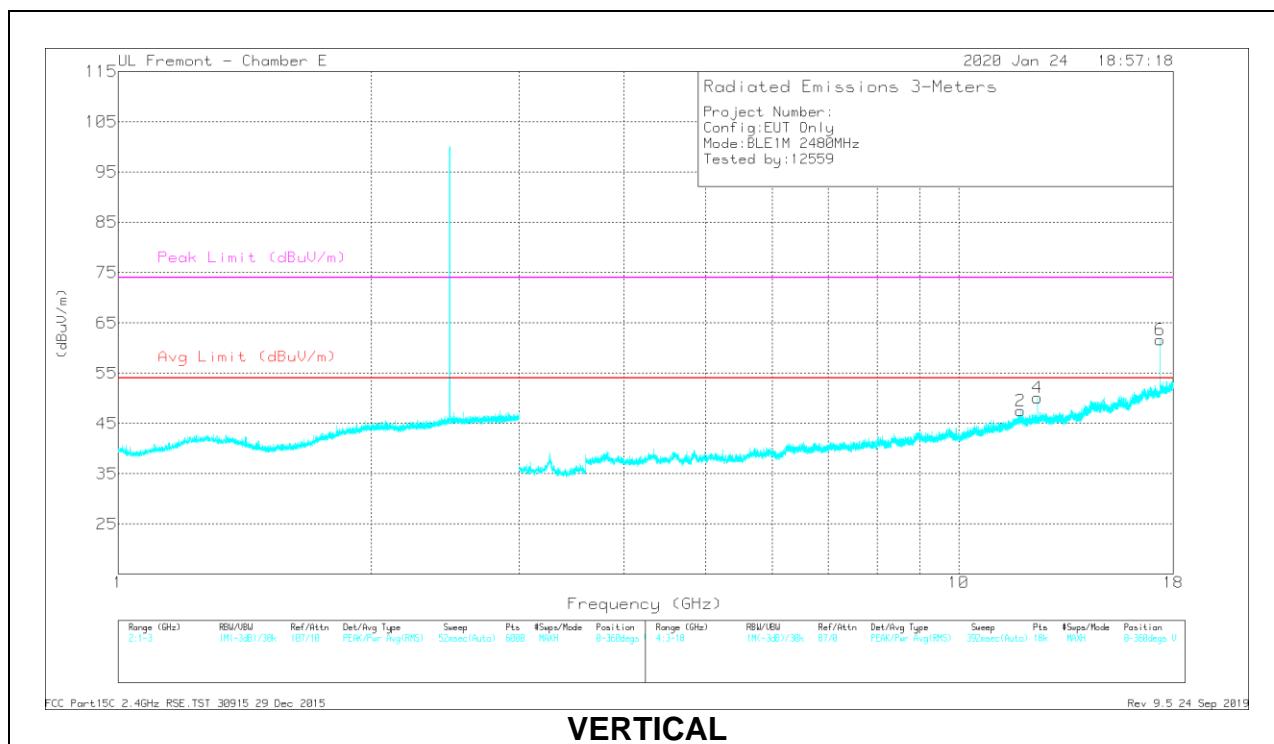
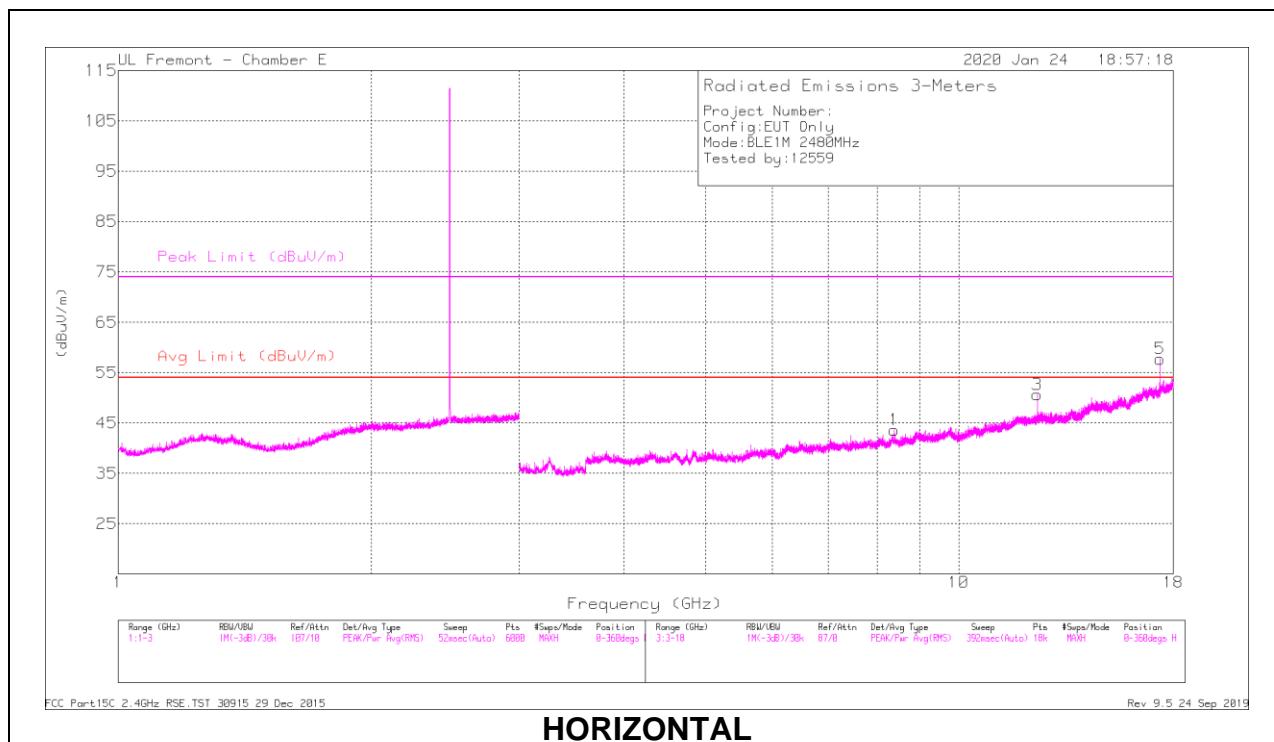
| Markers | Frequency (GHz) | Meter Reading (dBuV) | Det  | AF T119 (dB/m) | Amp/Cbl/Filt/P ad (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---------|-----------------|----------------------|------|----------------|------------------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 3       | * 12.20133      | 36.1                 | PK2  | 39             | -21.8                  | 53.3                       | -                  | -           | 74                  | -20.7          | 122            | 105         | H        |
|         | * 12.20253      | 24.38                | MAv1 | 39             | -21.8                  | 41.58                      | 54                 | -12.42      | -                   | -              | 122            | 105         | H        |
| 4       | * 12.20105      | 39.66                | PK2  | 39             | -21.8                  | 56.86                      | -                  | -           | 74                  | -17.14         | 167            | 101         | V        |
|         | * 12.20101      | 30.21                | MAv1 | 39             | -21.8                  | 47.41                      | 54                 | -6.59       | -                   | -              | 167            | 101         | V        |
| 1       | 8.91342         | 38.51                | PK2  | 36.1           | -23.9                  | 50.71                      | -                  | -           | -                   | -              | 182            | 305         | H        |
| 2       | 8.95125         | 37.6                 | PK2  | 36.1           | -24.1                  | 49.6                       | -                  | -           | -                   | -              | 225            | 105         | V        |
| 6       | 17.08133        | 41.6                 | PK2  | 41.3           | -18.2                  | 64.7                       | -                  | -           | -                   | -              | 238            | 116         | V        |
| 5       | 17.08159        | 40.48                | PK2  | 41.3           | -18.2                  | 63.58                      | -                  | -           | -                   | -              | 208            | 198         | H        |

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

## HIGH CHANNEL RESULTS



## RADIATED EMISSIONS

| Markers | Frequency (GHz) | Meter Reading (dBuV) | Det  | AF T119 (dB/m) | Amp/Cbl/Flt/P ad (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---------|-----------------|----------------------|------|----------------|-----------------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1       | * 8.37899       | 38.93                | PK2  | 35.8           | -25.4                 | 49.33                      | -                  | -           | 74                  | -24.67         | 210            | 173         | H        |
|         | * 8.37712       | 27.25                | MAv1 | 35.8           | -25.4                 | 37.65                      | 54                 | -16.35      | -                   | -              | 210            | 173         | H        |
| 3       | * 12.39851      | 40.54                | PK2  | 39             | -21.8                 | 57.74                      | -                  | -           | 74                  | -16.26         | 286            | 101         | H        |
|         | * 12.39891      | 31.72                | MAv1 | 39             | -21.8                 | 48.92                      | 54                 | -5.08       | -                   | -              | 286            | 101         | H        |
| 2       | * 11.85341      | 36.2                 | PK2  | 38.9           | -22                   | 53.1                       | -                  | -           | 74                  | -20.9          | 71             | 366         | V        |
|         | * 11.85163      | 24.66                | MAv1 | 38.9           | -22                   | 41.56                      | 54                 | -12.44      | -                   | -              | 71             | 366         | V        |
| 4       | * 12.4013       | 38.67                | PK2  | 39             | -21.8                 | 55.87                      | -                  | -           | 74                  | -18.13         | 190            | 197         | V        |
|         | * 12.40103      | 26.88                | MAv1 | 39             | -21.8                 | 44.08                      | 54                 | -9.92       | -                   | -              | 190            | 197         | V        |
| 5       | 17.35831        | 39.83                | PK2  | 41.3           | -17.6                 | 63.53                      | -                  | -           | -                   | -              | 114            | 101         | H        |
| 6       | 17.36173        | 42.7                 | PK2  | 41.3           | -17.6                 | 66.4                       | -                  | -           | -                   | -              | 240            | 117         | V        |

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

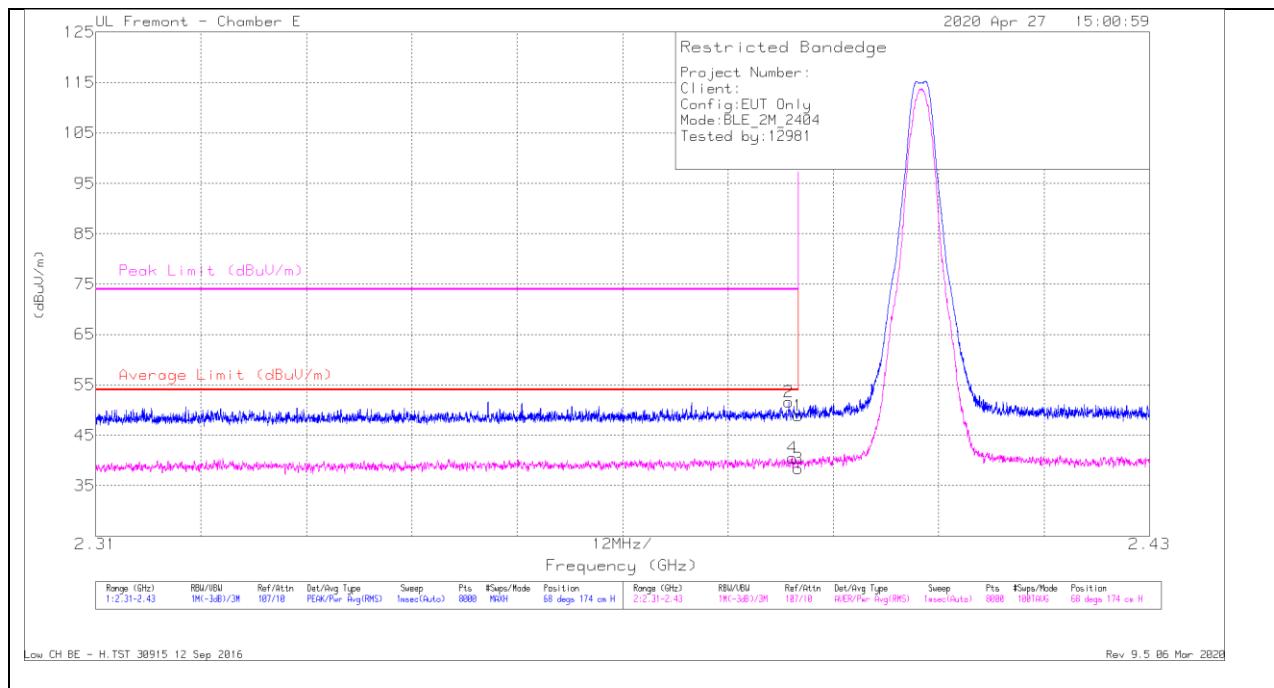
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

### 10.2.2. BLE (2Mbps)

#### BANDEDGE (LOW CHANNEL)

#### HORIZONTAL RESULT



| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T712 (dB/m) | Amp/Cbl/Fltr/Pa d (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|----------------|------------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.38999       | 43.04                | Pk  | 32.2           | -26.4                  | 48.84                      | -                      | -           | 74                  | -25.16         | 68             | 174         | H        |
| 2      | * 2.38893       | 45.84                | Pk  | 32.2           | -26.4                  | 51.64                      | -                      | -           | 74                  | -22.36         | 68             | 174         | H        |
| 3      | * 2.38999       | 32.66                | RMS | 32.2           | -26.4                  | 38.46                      | 54                     | -15.54      | -                   | -              | 68             | 174         | H        |
| 4      | * 2.38933       | 34.74                | RMS | 32.2           | -26.4                  | 40.54                      | 54                     | -13.46      | -                   | -              | 68             | 174         | H        |

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

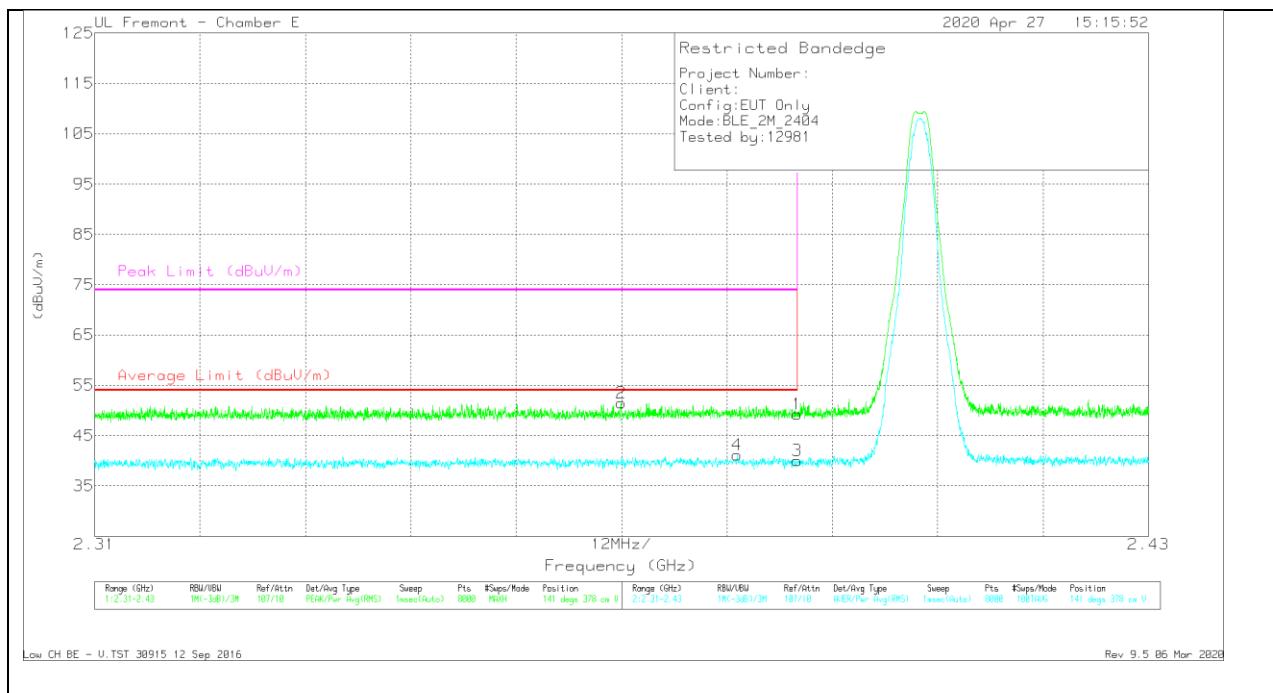
PK - Peak detector

RMS - RMS detection

Low CH BE - H.TST 30915 12 Sep 2016

Rev 9.5 06 Mar 2020

## VERTICAL RESULT



| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T712 (dB/m) | Amp/Cbl/Fltr/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|----------------|-----------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.38999       | 43.46                | Pk  | 32.2           | -26.4                 | 49.26                      | -                      | -           | 74                  | -24.74         | 141            | 378         | V        |
| 2      | * 2.36993       | 45.89                | Pk  | 32.1           | -26.5                 | 51.49                      | -                      | -           | 74                  | -22.51         | 141            | 378         | V        |
| 3      | * 2.38999       | 34.22                | RMS | 32.2           | -26.4                 | 40.02                      | 54                     | -13.98      | -                   | -              | 141            | 378         | V        |
| 4      | * 2.38316       | 35.41                | RMS | 32.2           | -26.5                 | 41.11                      | 54                     | -12.89      | -                   | -              | 141            | 378         | V        |

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK - Peak detector

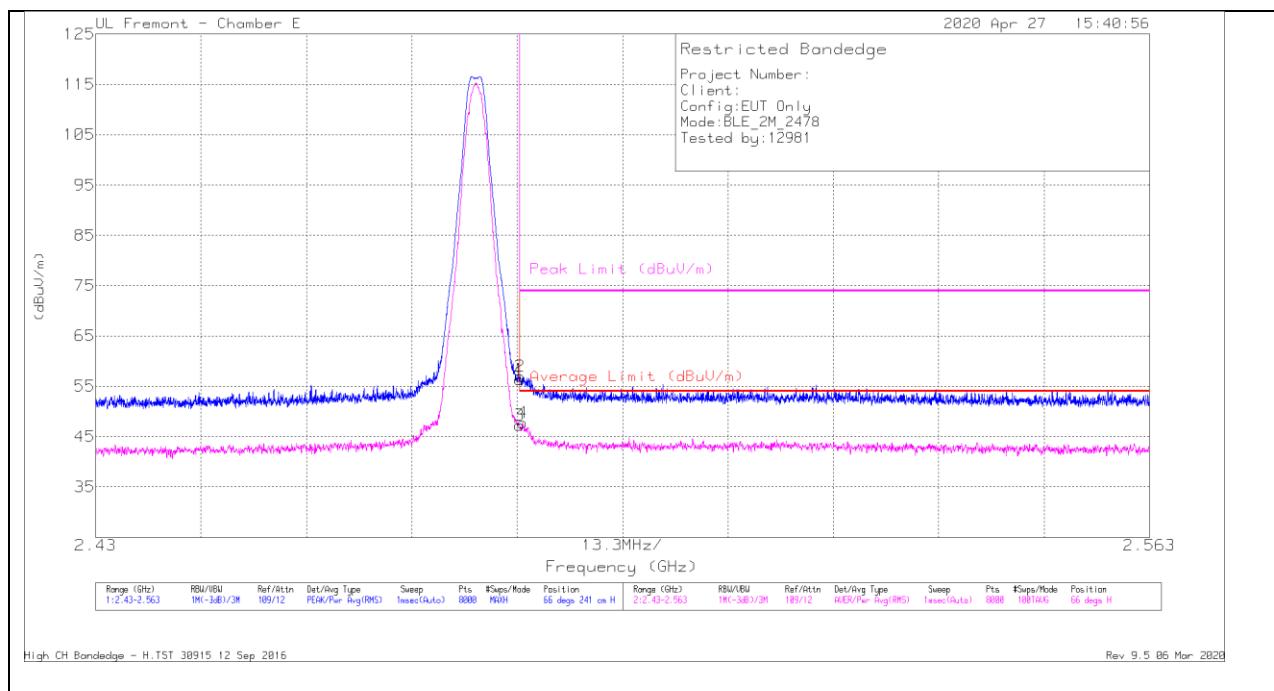
RMS - RMS detection

Low CH BE - V.TST 30915 12 Sep 2016

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## BANDEDGE (HIGH CHANNEL)

### HORIZONTAL RESULT



| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T7712 (dB/m) | Amp/Cbl/Fltr/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|-----------------|-----------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.48351       | 41.99                | Pk  | 32.8            | -18.4                 | 56.39                      | -                      | -           | 74                  | -17.61         | 66             | 241         | H        |
| 2      | * 2.48359       | 42.54                | Pk  | 32.8            | -18.4                 | 56.94                      | -                      | -           | 74                  | -17.06         | 66             | 241         | H        |
| 3      | * 2.48351       | 32.82                | RMS | 32.8            | -18.4                 | 47.22                      | 54                     | -6.78       | -                   | -              | 66             | 241         | H        |
| 4      | * 2.48385       | 33.34                | RMS | 32.8            | -18.4                 | 47.74                      | 54                     | -6.26       | -                   | -              | 66             | 241         | H        |

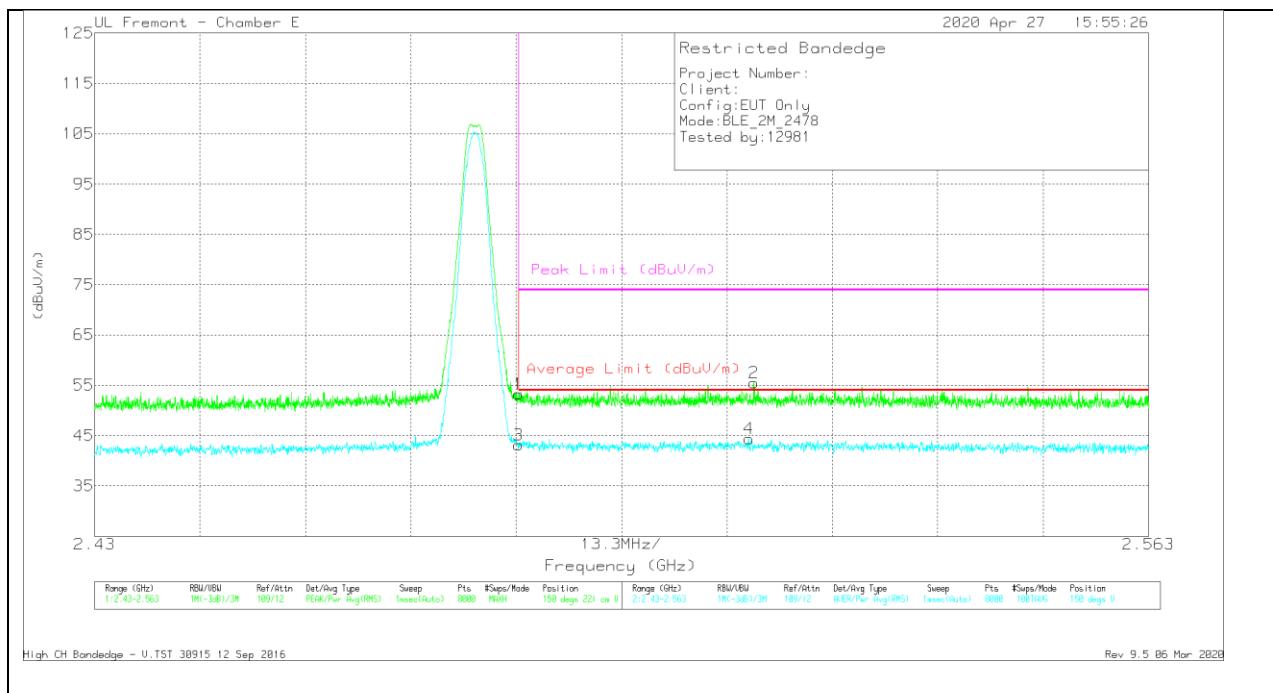
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK - Peak detector

RMS - RMS detection

High CH Bandedge - H.TST 30915 12 Sep 2016  
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## VERTICAL RESULT



| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T712 (dB/m) | Amp/Cbl/Fltr/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|----------------|-----------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 2.48351       | 38.89                | Pk  | 32.8           | -18.4                 | 53.29                      | -                      | -           | 74                  | -20.71         | 150            | 221         | V        |
| 3      | * 2.48351       | 28.73                | RMS | 32.8           | -18.4                 | 43.13                      | 54                     | -10.87      | -                   | -              | 150            | 221         | V        |
| 4      | 2.51255         | 29.81                | RMS | 32.9           | -18.3                 | 44.41                      | 54                     | -9.59       | -                   | -              | 150            | 221         | V        |
| 2      | 2.51318         | 40.89                | Pk  | 32.9           | -18.3                 | 55.49                      | -                      | -           | 74                  | -18.51         | 150            | 221         | V        |

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK - Peak detector

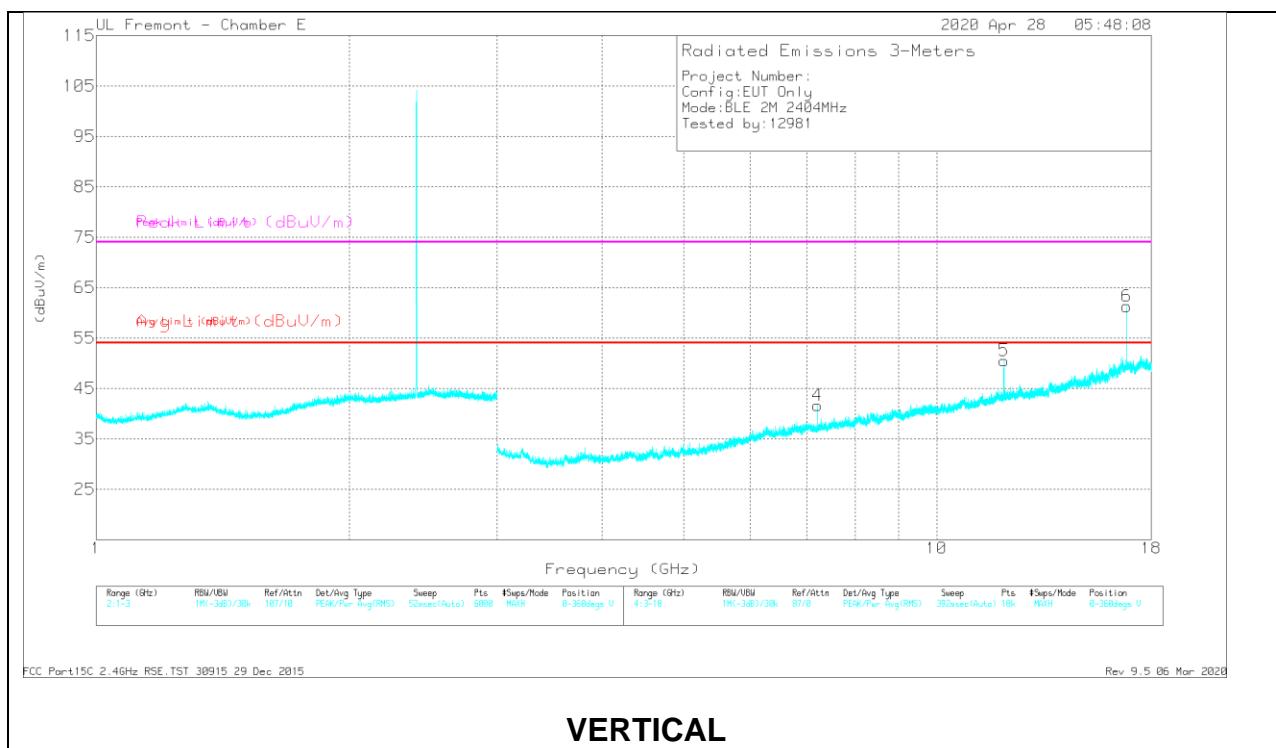
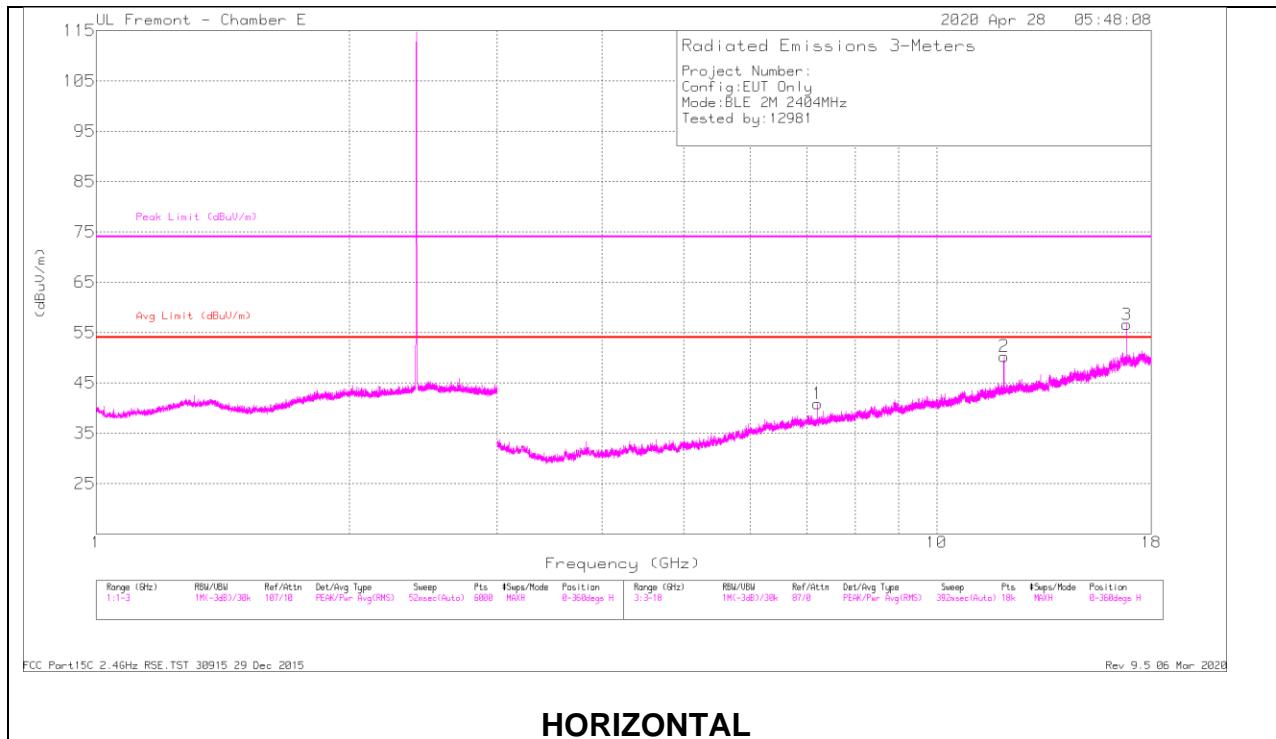
RMS - RMS detection

High CH Bandedge - V.TST 30915 12 Sep 2016

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## HARMONICS AND SPURIOUS EMISSIONS

### LOW CHANNEL RESULTS



## RADIATED EMISSIONS

### Radiated Emissions

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det  | AF T712 (dB/m) | Amp/Cbl/Filtr/P ad (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|----------------|-------------------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 2      | * 12.02225      | 41                   | PK2  | 38.7           | -23                     | 56.7                       | -                  | -           | 74                  | -17.3          | 134            | 103         | H        |
|        | * 12.02227      | 32.29                | MAv1 | 38.7           | -23                     | 47.99                      | 54                 | -6.01       | -                   | -              | 134            | 103         | H        |
| 5      | * 12.0223       | 34.98                | PK2  | 38.6           | -23                     | 50.58                      | -                  | -           | 74                  | -23.42         | 97             | 148         | V        |
|        | * 12.02043      | 23.83                | MAv1 | 38.6           | -23                     | 39.43                      | 54                 | -14.57      | -                   | -              | 97             | 148         | V        |
| 1      | 7.21044         | 40.57                | PK2  | 35.6           | -28.5                   | 47.67                      | -                  | -           | -                   | -              | 263            | 285         | H        |
|        | 7.21064         | 31.1                 | MAv1 | 35.6           | -28.5                   | 38.2                       | -                  | -           | -                   | -              | 263            | 285         | H        |
| 4      | 7.21319         | 32.76                | MAv1 | 35.7           | -28.4                   | 40.06                      | -                  | -           | -                   | -              | 265            | 304         | V        |
|        | 7.21338         | 42.04                | PK2  | 35.7           | -28.4                   | 49.34                      | -                  | -           | -                   | -              | 265            | 304         | V        |
| 6      | 16.82437        | 43.87                | PK2  | 41.8           | -19.6                   | 66.07                      | -                  | -           | -                   | -              | 277            | 101         | V        |
|        | 16.82453        | 36.1                 | MAv1 | 41.8           | -19.6                   | 58.3                       | -                  | -           | -                   | -              | 277            | 101         | V        |
| 3      | 16.83112        | 28.13                | MAv1 | 41.8           | -19.3                   | 50.63                      | -                  | -           | -                   | -              | 265            | 101         | H        |
|        | 16.83128        | 40.39                | PK2  | 41.8           | -19.3                   | 62.89                      | -                  | -           | -                   | -              | 265            | 101         | H        |

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

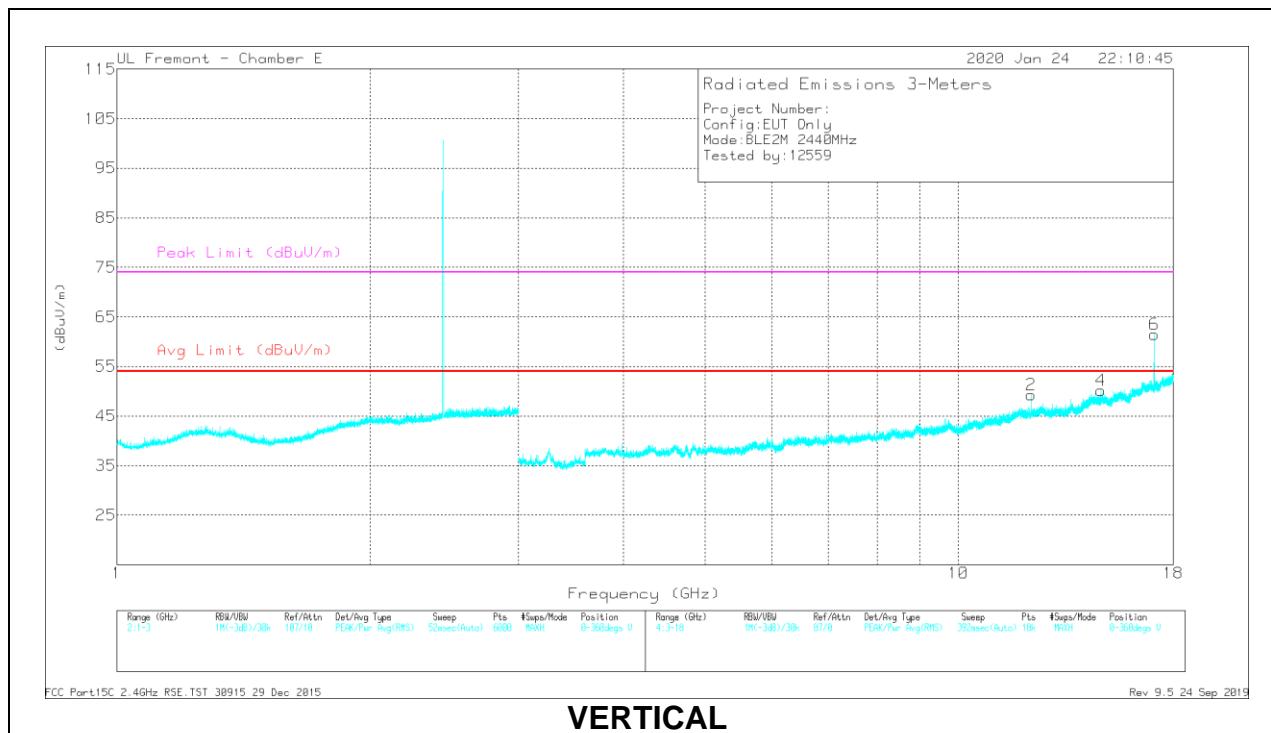
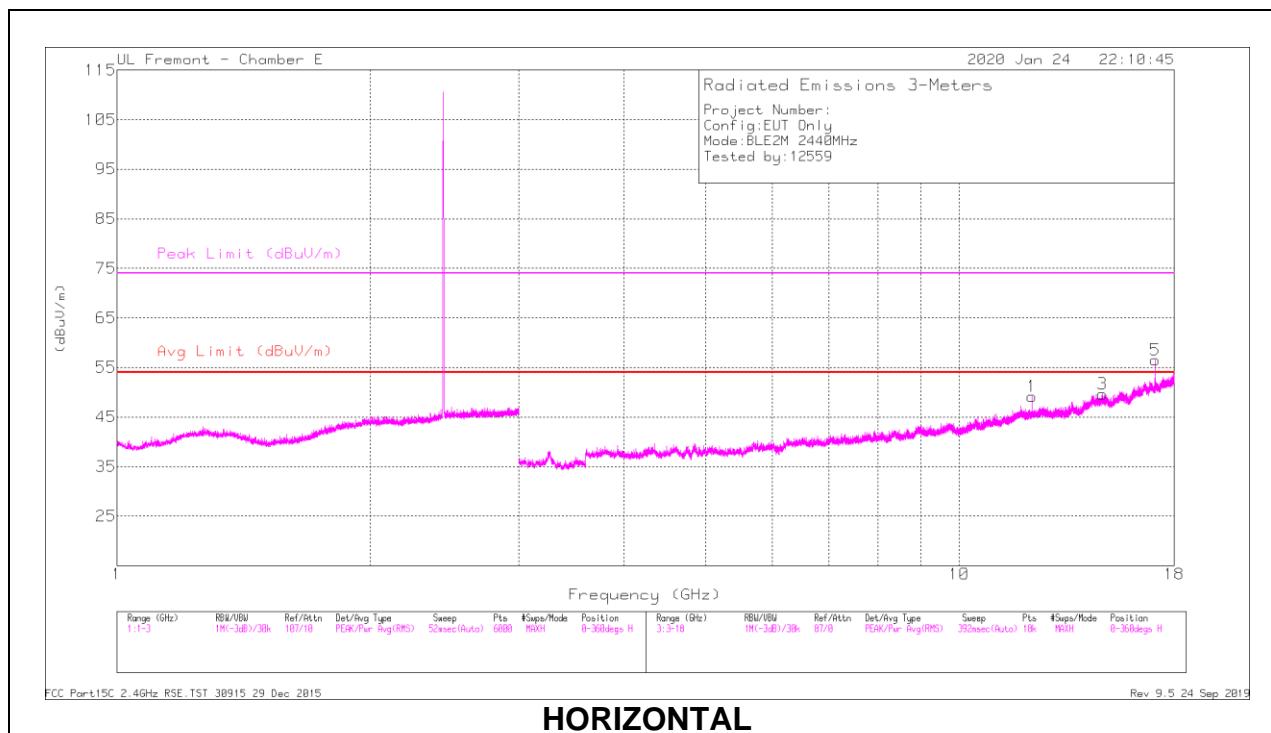
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

FCC Part15C 2.4GHz RSE.TST 30915 29 Dec 2015

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## MID CHANNEL RESULTS



## RADIATED EMISSIONS

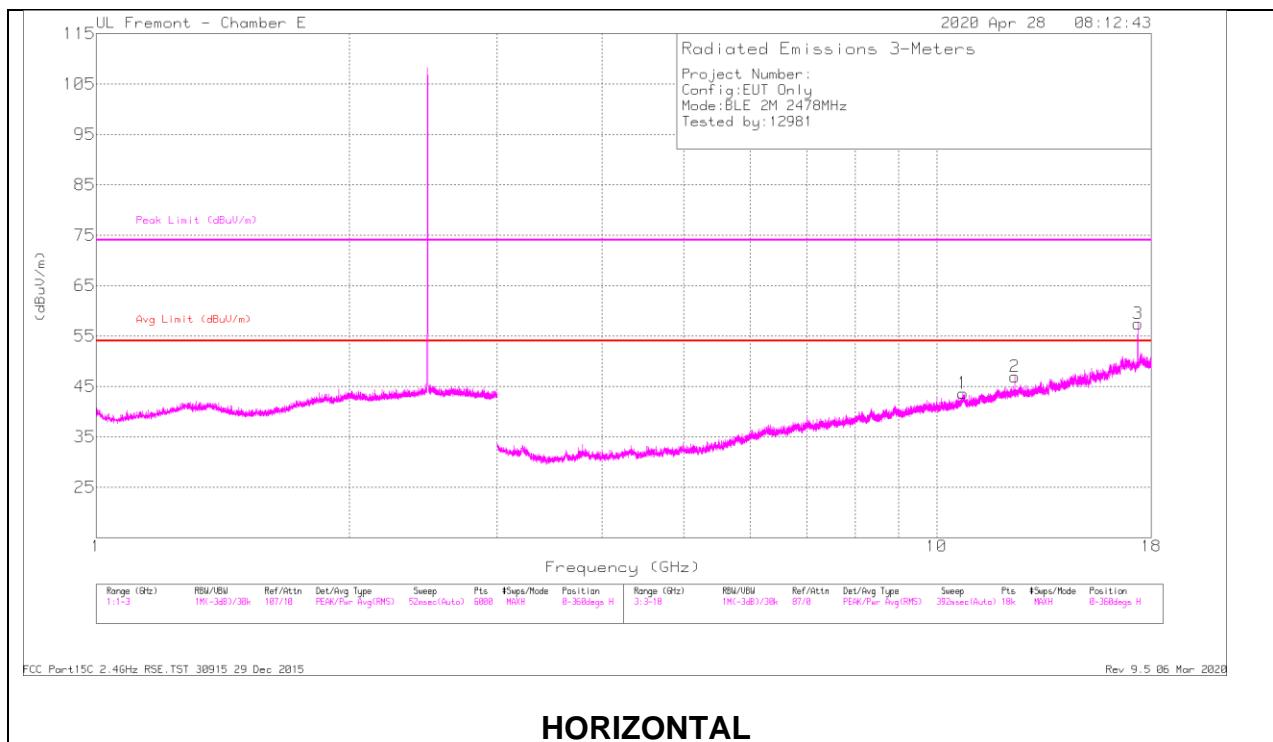
| Markers | Frequency (GHz) | Meter Reading (dBuV) | Det  | AF T119 (dB/m) | Amp/CbI/Flt/P ad (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---------|-----------------|----------------------|------|----------------|-----------------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1       | * 12.20217      | 38.68                | PK2  | 39             | -21.8                 | 55.88                      | -                  | -           | 74                  | -18.12         | 277            | 102         | H        |
|         | * 12.20221      | 28.61                | MAv1 | 39             | -21.8                 | 45.81                      | 54                 | -8.19       | -                   | -              | 277            | 102         | H        |
| 2       | * 12.20246      | 38.93                | PK2  | 39             | -21.8                 | 56.13                      | -                  | -           | 74                  | -17.87         | 336            | 101         | V        |
|         | * 12.20215      | 28.78                | MAv1 | 39             | -21.8                 | 45.98                      | 54                 | -8.02       | -                   | -              | 336            | 101         | V        |
| 4       | 14.76338        | 35.53                | PK2  | 40             | -20                   | 55.53                      | -                  | -           | -                   | -              | 32             | 258         | V        |
| 3       | 14.79783        | 36.15                | PK2  | 40             | -20                   | 56.15                      | -                  | -           | -                   | -              | 233            | 196         | H        |
| 5       | 17.07602        | 39.66                | PK2  | 41.4           | -18.2                 | 62.86                      | -                  | -           | -                   | -              | 23             | 196         | H        |
| 6       | 17.08331        | 43.36                | PK2  | 41.4           | -18.2                 | 66.56                      | -                  | -           | -                   | -              | 25             | 101         | V        |

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

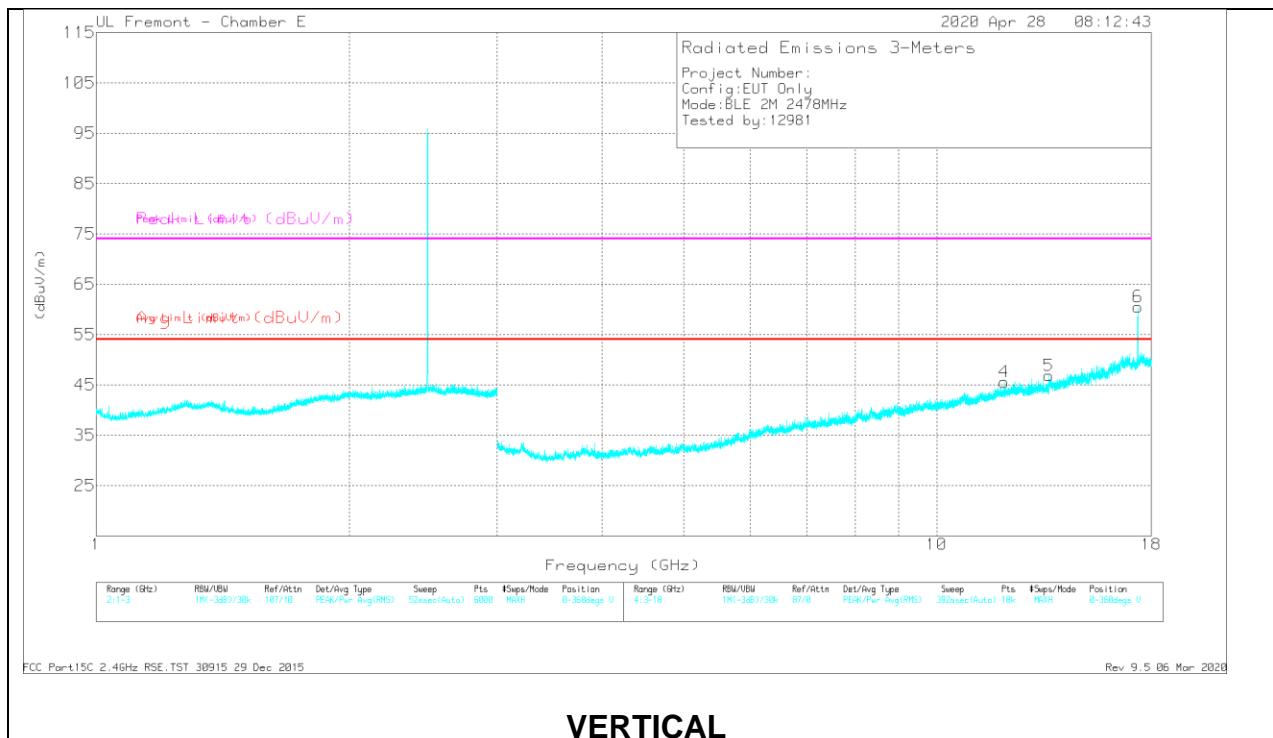
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

## HIGH CHANNEL RESULTS



## HORIZONTAL



## VERTICAL

## RADIATED EMISSIONS

| Market | Frequency (GHz) | Meter Reading (dBuV) | Det  | AF T712 (dB/m) | Amp/Cbl/Filt/P ad (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|----------------|------------------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1      | * 10.74568      | 37.79                | PK2  | 37.7           | -24.7                  | 50.79                      | -                  | -           | 74                  | -23.21         | 272            | 160         | H        |
|        | * 10.74385      | 26.05                | MAv1 | 37.7           | -24.7                  | 39.05                      | 54                 | -14.95      | -                   | -              | 272            | 160         | H        |
| 2      | * 12.38752      | 38.46                | PK2  | 38.9           | -23.2                  | 54.16                      | -                  | -           | 74                  | -19.84         | 339            | 103         | H        |
|        | * 12.38755      | 28.59                | MAv1 | 38.9           | -23.2                  | 44.29                      | 54                 | -9.71       | -                   | -              | 339            | 103         | H        |
| 4      | * 12.0305       | 35.39                | PK2  | 38.7           | -23                    | 51.09                      | -                  | -           | 74                  | -22.91         | 186            | 142         | V        |
|        | * 12.02873      | 24.4                 | MAv1 | 38.7           | -23                    | 40.1                       | 54                 | -13.9       | -                   | -              | 186            | 142         | V        |
| 5      | 13.60255        | 36.1                 | PK2  | 38.6           | -22.1                  | 52.6                       | -                  | -           | -                   | -              | 210            | 231         | V        |
|        | 13.60195        | 25.3                 | MAv1 | 38.6           | -22.1                  | 41.8                       | -                  | -           | -                   | -              | 210            | 231         | V        |
| 6      | 17.34948        | 43.24                | PK2  | 41.2           | -19.4                  | 65.04                      | -                  | -           | -                   | -              | 77             | 101         | V        |
|        | 17.34924        | 35                   | MAv1 | 41.2           | -19.4                  | 56.8                       | -                  | -           | -                   | -              | 77             | 101         | V        |
| 3      | 17.34943        | 41.36                | PK2  | 41.2           | -19.4                  | 63.16                      | -                  | -           | -                   | -              | 173            | 101         | H        |
|        | 17.34932        | 32.13                | MAv1 | 41.2           | -19.4                  | 53.93                      | -                  | -           | -                   | -              | 173            | 101         | H        |

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK2 - KDB558074 Method: Maximum Peak

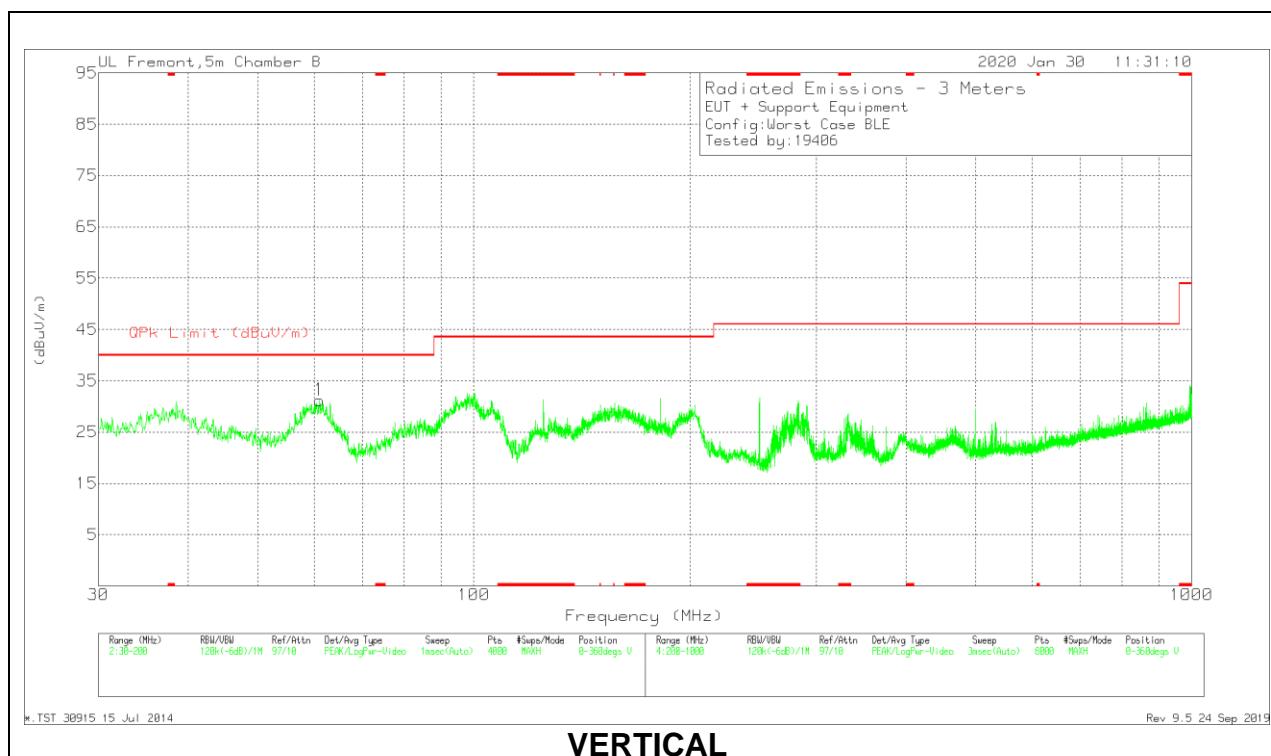
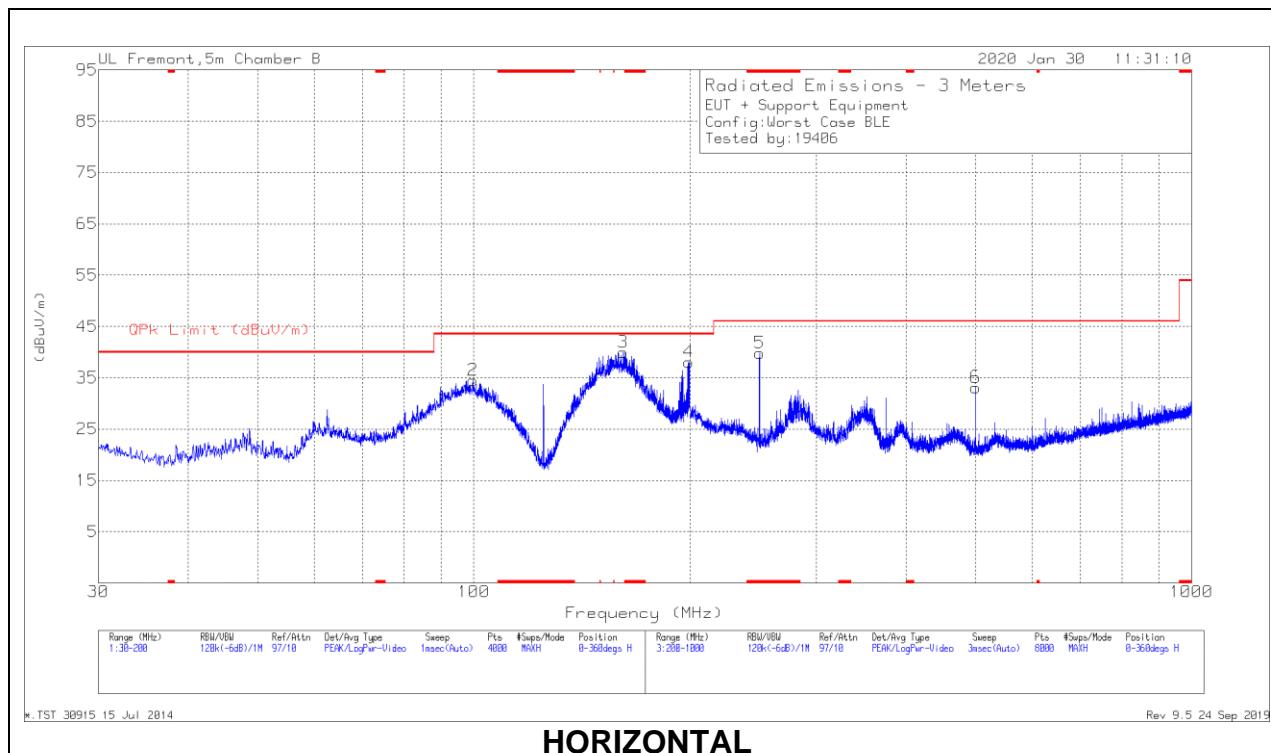
MAv1 - KDB558074 Option 1 Maximum RMS Average

FCC Part15C 2.4GHz RSE.TST 30915 29 Dec 2015

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### 10.3. WORST CASE BELOW 1 GHz

#### SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)



### Below 1GHz Data

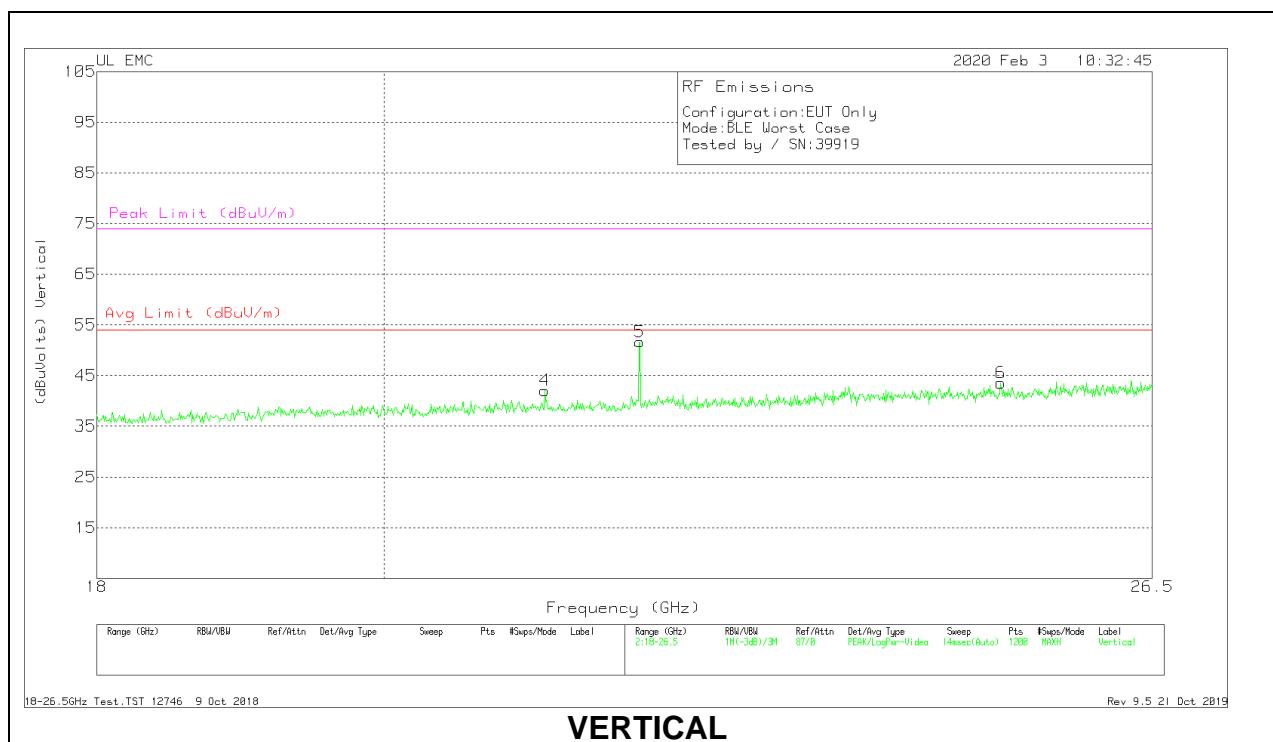
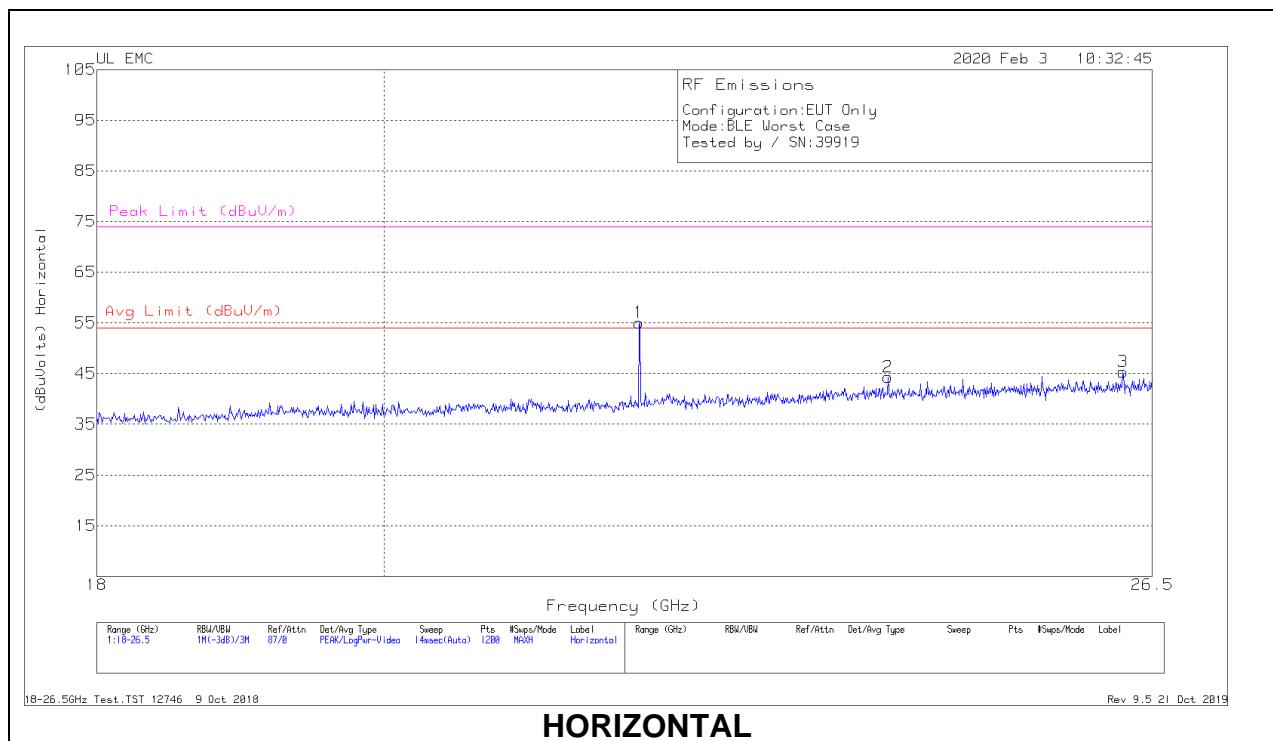
| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | AF T408 (dB/m) | Amp/Cbl (dB) | Corrected Reading (dBuV/m) | QPk Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|----------------|--------------|----------------------------|--------------------|-------------|----------------|-------------|----------|
| 5      | * 249.9955      | 54.57                | Qp  | 15.4           | -29.8        | 40.17                      | 46.02              | -5.85       | 139            | 133         | H        |
| 1      | 61.0224         | 45.97                | Qp  | 11.6           | -31.1        | 26.47                      | 40                 | -13.53      | 319            | 114         | V        |
| 2      | 99.6171         | 46.09                | Qp  | 14.1           | -30.7        | 29.49                      | 43.52              | -14.03      | 353            | 322         | H        |
| 3      | 161.5551        | 49.46                | Qp  | 16.3           | -30.3        | 35.46                      | 43.52              | -8.06       | 277            | 228         | H        |
| 4      | 199.2239        | 36.88                | Qp  | 16.8           | -30.1        | 23.58                      | 43.52              | -19.94      | 328            | 255         | H        |
| 6      | 500.004         | 40.67                | Qp  | 21.6           | -29          | 33.27                      | 46.02              | -12.75      | 109            | 217         | H        |

\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Qp - Quasi-Peak detector

## 10.4. WORST CASE ABOVE 18 GHz

### SPURIOUS EMISSIONS 18 TO 26 GHz (WORST-CASE CONFIGURATION)



## Below 1GHz Data

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | T447 AF (dB/m) | Amp/Cbl (dB) | Dist Corr (dB) | Corrected Reading (dBuVolts) | Avg Limit (dBuV/m) | Margin (dB) |
|--------|-----------------|----------------------|-----|----------------|--------------|----------------|------------------------------|--------------------|-------------|
| 1      | 21.9577         | 40.93                | Av  | 33.3           | -20.8        | -9.5           | 43.93                        | 54                 | -10.07      |
| 2      | 21.95766        | 44.86                | Av  | 33.3           | -20.8        | -9.5           | 47.86                        | 54                 | -6.14       |
| 3      | 24.05237        | 22.16                | Av  | 34.3           | -19.5        | -9.5           | 27.46                        | 54                 | -26.54      |
| 4      | 26.21701        | 24.28                | Av  | 34.5           | -19.9        | -9.5           | 29.38                        | 54                 | -24.62      |
| 5      | 21.21129        | 22.43                | Av  | 33             | -21.2        | -9.5           | 24.73                        | 54                 | -29.27      |
| 6      | 25.06745        | 22.77                | Av  | 34.5           | -19.7        | -9.5           | 28.07                        | 54                 | -25.93      |

Av - Average detection

## 11. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

| Frequency of Emission<br>(MHz) | Conducted Limit (dBuV) |           |
|--------------------------------|------------------------|-----------|
|                                | Quasi-Peak             | Average   |
| 0.15-0.5                       | 66 to 56*              | 56 to 46* |
| 0.5-5                          | 56                     | 46        |
| 5-30                           | 60                     | 50        |

\*Decreases with the logarithm of the frequency

### TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

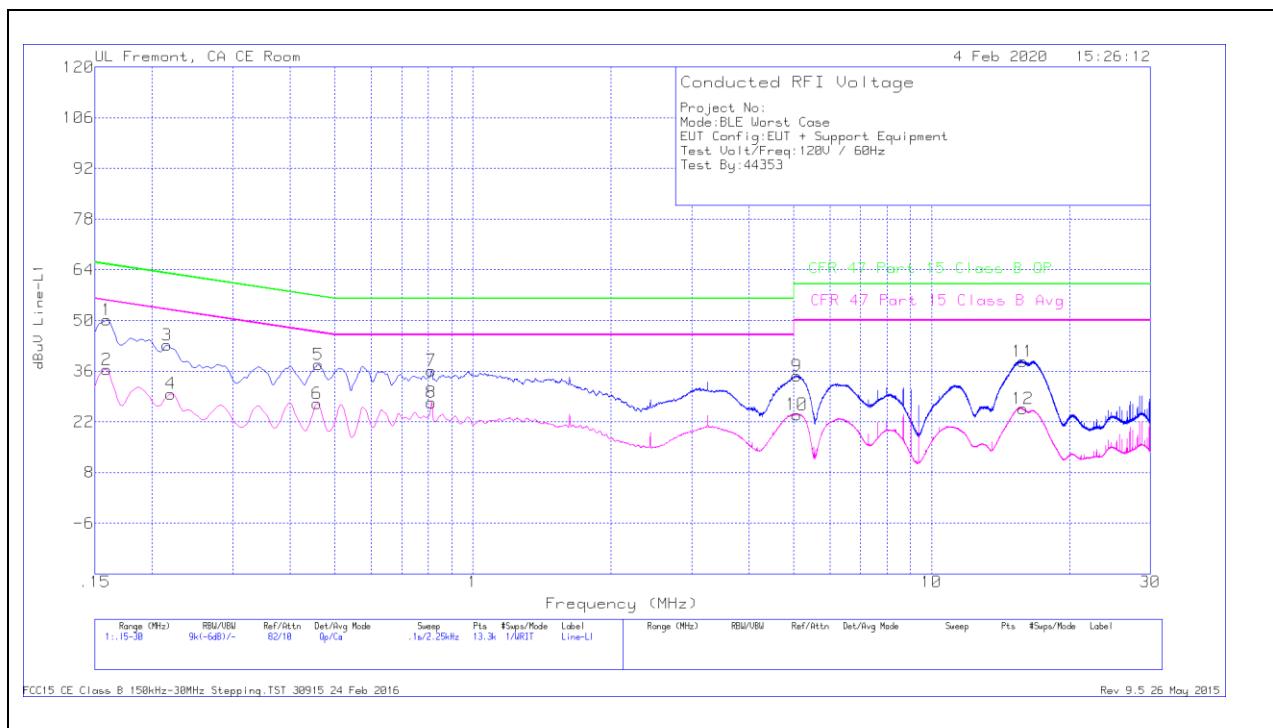
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

### RESULTS

### 11.1.1. AC Line Host

#### LINE 1 RESULTS

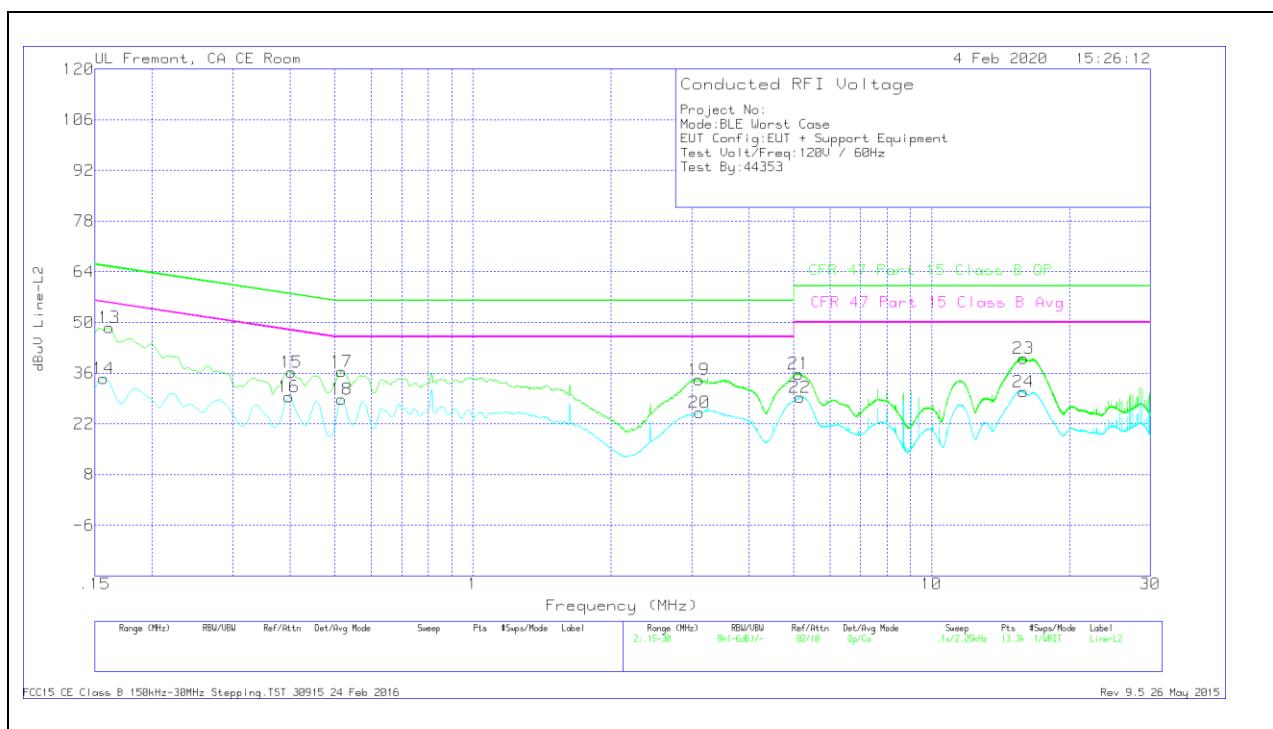


| Range 1: Line-L1 .15 - 30MHz |                 |                      |     |              |                 |              |                        |                           |                |                            |                       |
|------------------------------|-----------------|----------------------|-----|--------------|-----------------|--------------|------------------------|---------------------------|----------------|----------------------------|-----------------------|
| Marker                       | Frequency (MHz) | Meter Reading (dBuV) | Det | LISN L1 (dB) | LC Cables C1&C3 | Limiter (dB) | Corrected Reading dBuV | CFR 47 Part 15 Class B QP | QP Margin (dB) | CFR 47 Part 15 Class B Avg | Av(CISPR) Margin (dB) |
| 1                            | .159            | 40.02                | Qp  | .1           | 0               | 10           | 50.12                  | 65.52                     | -15.4          | -                          | -                     |
| 2                            | .159            | 26.3                 | Ca  | .1           | 0               | 10           | 36.4                   | -                         | -              | 55.52                      | -19.12                |
| 3                            | .21525          | 33.17                | Qp  | 0            | 0               | 10           | 43.17                  | 63                        | -19.83         | -                          | -                     |
| 4                            | .21975          | 19.75                | Ca  | 0            | 0               | 10           | 29.75                  | -                         | -              | 52.83                      | -23.08                |
| 5                            | .4605           | 27.81                | Qp  | 0            | 0               | 10           | 37.81                  | 56.68                     | -18.87         | -                          | -                     |
| 6                            | .45825          | 17.09                | Ca  | 0            | 0               | 10           | 27.09                  | -                         | -              | 46.72                      | -19.63                |
| 7                            | .8115           | 26.18                | Qp  | 0            | 0               | 10           | 36.18                  | 56                        | -19.82         | -                          | -                     |
| 8                            | .8115           | 17.32                | Ca  | 0            | 0               | 10           | 27.32                  | -                         | -              | 46                         | -18.68                |
| 9                            | 5.08988         | 24.45                | Qp  | 0            | .1              | 10.1         | 34.65                  | 60                        | -25.35         | -                          | -                     |
| 10                           | 5.08875         | 13.81                | Ca  | 0            | .1              | 10.1         | 24.01                  | -                         | -              | 50                         | -25.99                |
| 11                           | 15.81           | 28.16                | Qp  | 0            | .3              | 10.2         | 38.66                  | 60                        | -21.34         | -                          | -                     |
| 12                           | 15.8055         | 15.17                | Ca  | 0            | .3              | 10.2         | 25.67                  | -                         | -              | 50                         | -24.33                |

Qp - Quasi-Peak detector

Ca - CISPR average detection

## LINE 2 RESULTS



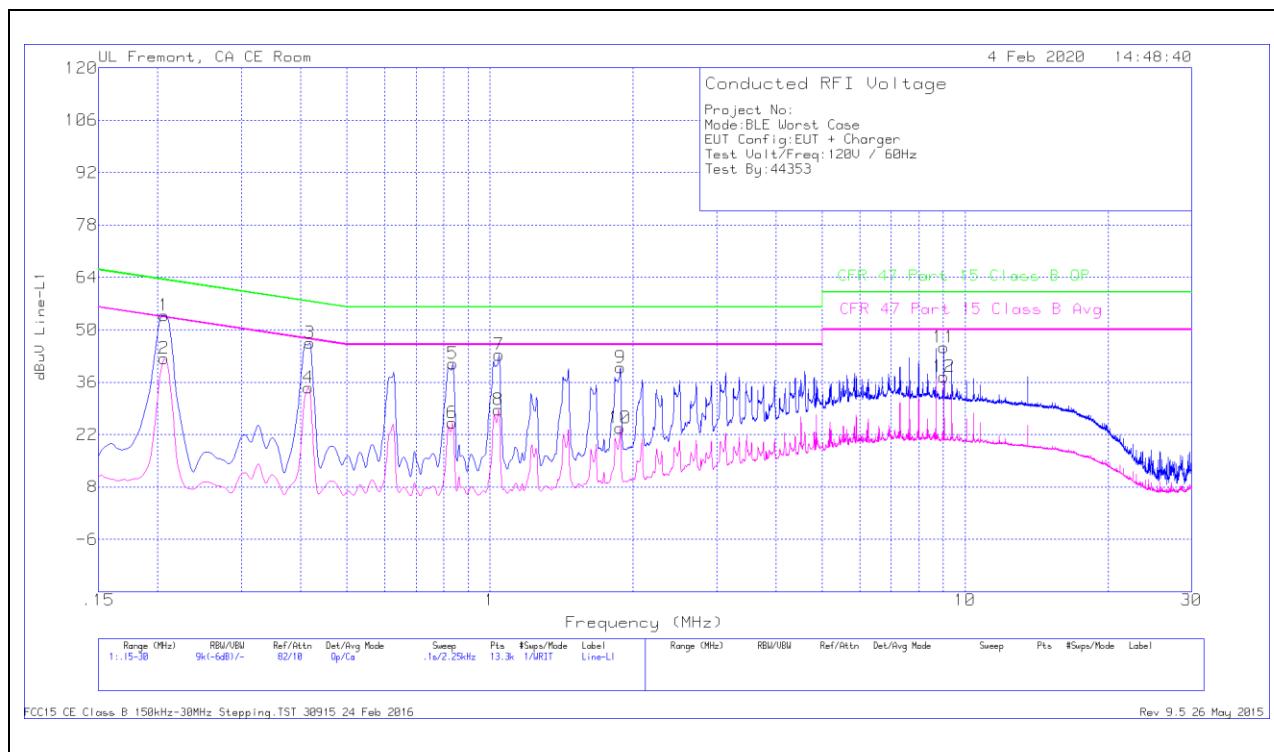
| Range 2: Line-L2 .15 - 30MHz |                 |                      |     |              |                 |              |                        |                           |                |                            |                       |
|------------------------------|-----------------|----------------------|-----|--------------|-----------------|--------------|------------------------|---------------------------|----------------|----------------------------|-----------------------|
| Marker                       | Frequency (MHz) | Meter Reading (dBuV) | Det | LISN L2 (dB) | LC Cables C2&C3 | Limiter (dB) | Corrected Reading dBuV | CFR 47 Part 15 Class B QP | QP Margin (dB) | CFR 47 Part 15 Class B Avg | Av(CISPR )Margin (dB) |
| 13                           | .16125          | 38.53                | Qp  | 0            | 0               | 10           | 48.53                  | 65.4                      | -16.87         | -                          | -                     |
| 14                           | .15675          | 24.38                | Ca  | .1           | 0               | 10           | 34.48                  | -                         | -              | 55.63                      | -21.15                |
| 15                           | .402            | 26.25                | Qp  | 0            | 0               | 10           | 36.25                  | 57.81                     | -21.56         | -                          | -                     |
| 16                           | .3975           | 19.54                | Ca  | 0            | 0               | 10           | 29.54                  | -                         | -              | 47.91                      | -18.37                |
| 17                           | .51675          | 26.43                | Qp  | 0            | 0               | 10           | 36.43                  | 56                        | -19.57         | -                          | -                     |
| 18                           | .51675          | 18.82                | Ca  | 0            | 0               | 10           | 28.82                  | -                         | -              | 46                         | -17.18                |
| 19                           | 3.10875         | 24.13                | Qp  | 0            | .1              | 10           | 34.23                  | 56                        | -21.77         | -                          | -                     |
| 20                           | 3.12225         | 15.04                | Ca  | 0            | .1              | 10           | 25.14                  | -                         | -              | 46                         | -20.86                |
| 21                           | 5.13825         | 25.63                | Qp  | 0            | .1              | 10.1         | 35.83                  | 60                        | -24.17         | -                          | -                     |
| 22                           | 5.16075         | 19.07                | Ca  | 0            | .1              | 10.1         | 29.27                  | -                         | -              | 50                         | -20.73                |
| 23                           | 15.85275        | 29.56                | Qp  | 0            | .3              | 10.2         | 40.06                  | 60                        | -19.94         | -                          | -                     |
| 24                           | 15.85388        | 20.32                | Ca  | 0            | .3              | 10.2         | 30.82                  | -                         | -              | 50                         | -19.18                |

Qp - Quasi-Peak detector

Ca - CISPR average detection

### 11.1.2. AC Line Norm

#### LINE 1 RESULTS

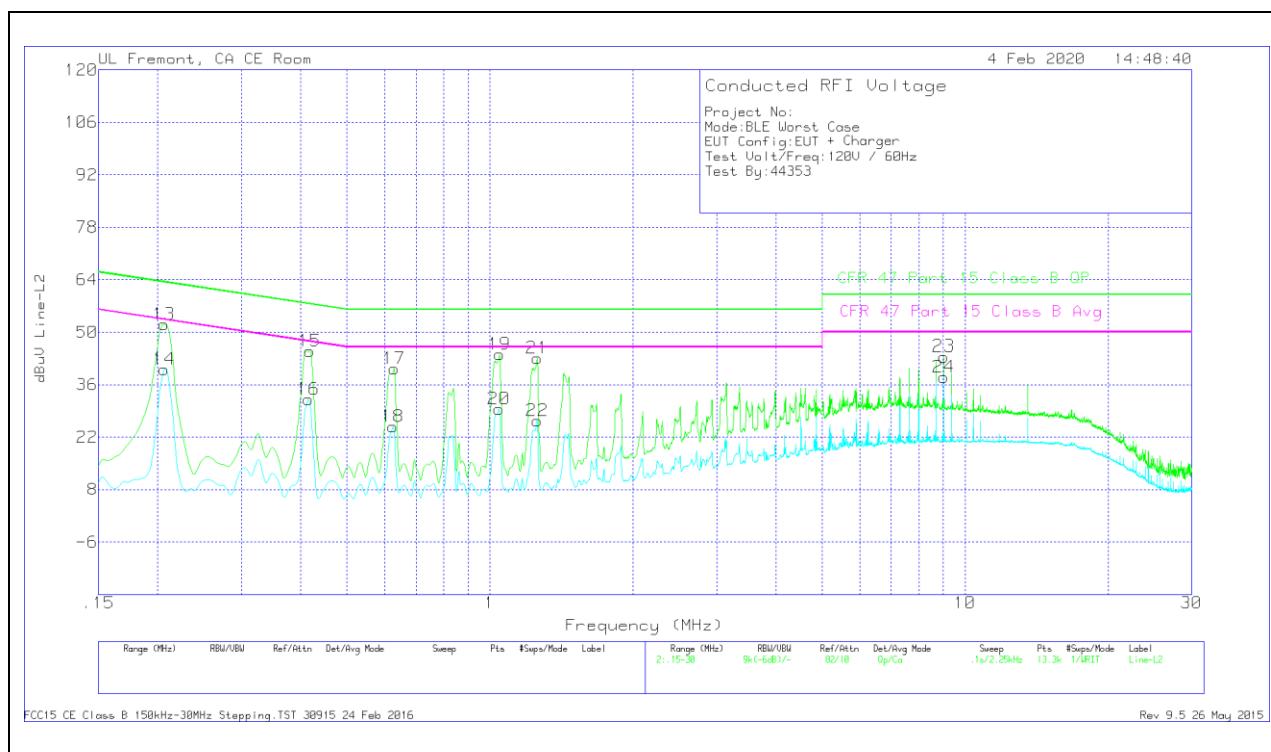


| Range 1: Line-L1 .15 - 30MHz |                 |                      |     |              |                 |              |                        |                           |                |                            |                       |
|------------------------------|-----------------|----------------------|-----|--------------|-----------------|--------------|------------------------|---------------------------|----------------|----------------------------|-----------------------|
| Marker                       | Frequency (MHz) | Meter Reading (dBuV) | Det | LISN L1 (dB) | LC Cables C1&C3 | Limiter (dB) | Corrected Reading dBuV | CFR 47 Part 15 Class B QP | QP Margin (dB) | CFR 47 Part 15 Class B Avg | Av(CISPR )Margin (dB) |
| 1                            | .20625          | 43.89                | Qp  | 0            | 0               | 10           | 53.89                  | 63.35                     | -9.46          | -                          | -                     |
| 2                            | .20625          | 32.38                | Ca  | 0            | 0               | 10           | 42.38                  | -                         | -              | 53.35                      | -10.97                |
| 3                            | .41775          | 36.59                | Qp  | 0            | 0               | 10           | 46.59                  | 57.49                     | -10.9          | -                          | -                     |
| 4                            | .4155           | 24.56                | Ca  | 0            | 0               | 10           | 34.56                  | -                         | -              | 47.54                      | -12.98                |
| 5                            | .83625          | 30.98                | Qp  | 0            | 0               | 10           | 40.98                  | 56                        | -15.02         | -                          | -                     |
| 6                            | .834            | 15.09                | Ca  | 0            | 0               | 10           | 25.09                  | -                         | -              | 46                         | -20.91                |
| 7                            | 1.0455          | 33.21                | Qp  | 0            | .1              | 10           | 43.31                  | 56                        | -12.69         | -                          | -                     |
| 8                            | 1.04325         | 18.53                | Ca  | 0            | .1              | 10           | 28.63                  | -                         | -              | 46                         | -17.37                |
| 9                            | 1.8825          | 29.85                | Qp  | 0            | .1              | 10           | 39.95                  | 56                        | -16.05         | -                          | -                     |
| 10                           | 1.88025         | 13.73                | Ca  | 0            | .1              | 10           | 23.83                  | -                         | -              | 46                         | -22.17                |
| 11                           | 9.033           | 35.02                | Qp  | 0            | .2              | 10.1         | 45.32                  | 60                        | -14.68         | -                          | -                     |
| 12                           | 9.033           | 27.12                | Ca  | 0            | .2              | 10.1         | 37.42                  | -                         | -              | 50                         | -12.58                |

Qp - Quasi-Peak detector

Ca - CISPR average detection

## LINE 2 RESULTS



| Range 2: Line-L2 .15 - 30MHz |                 |                      |     |              |                 |              |                        |                           |                |                            |                       |
|------------------------------|-----------------|----------------------|-----|--------------|-----------------|--------------|------------------------|---------------------------|----------------|----------------------------|-----------------------|
| Marker                       | Frequency (MHz) | Meter Reading (dBuV) | Det | LISN L2 (dB) | LC Cables C2&C3 | Limiter (dB) | Corrected Reading dBuV | CFR 47 Part 15 Class B QP | QP Margin (dB) | CFR 47 Part 15 Class B Avg | Av(CISPR )Margin (dB) |
| 13                           | .20625          | 42.04                | Qp  | 0            | 0               | 10           | 52.04                  | 63.35                     | -11.31         | -                          | -                     |
| 14                           | .20625          | 30.14                | Ca  | 0            | 0               | 10           | 40.14                  | -                         | -              | 53.35                      | -13.21                |
| 15                           | .41775          | 34.94                | Qp  | 0            | 0               | 10           | 44.94                  | 57.49                     | -12.55         | -                          | -                     |
| 16                           | .4155           | 22.1                 | Ca  | 0            | 0               | 10           | 32.1                   | -                         | -              | 47.54                      | -15.44                |
| 17                           | .62925          | 30.33                | Qp  | 0            | 0               | 10           | 40.33                  | 56                        | -15.67         | -                          | -                     |
| 18                           | .62475          | 14.75                | Ca  | 0            | 0               | 10           | 24.75                  | -                         | -              | 46                         | -21.25                |
| 19                           | 1.04775         | 34.05                | Qp  | 0            | .1              | 10           | 44.15                  | 56                        | -11.85         | -                          | -                     |
| 20                           | 1.0455          | 19.34                | Ca  | 0            | .1              | 10           | 29.44                  | -                         | -              | 46                         | -16.56                |
| 21                           | 1.257           | 32.9                 | Qp  | 0            | .1              | 10           | 43                     | 56                        | -13            | -                          | -                     |
| 22                           | 1.257           | 16.25                | Ca  | 0            | .1              | 10           | 26.35                  | -                         | -              | 46                         | -19.65                |
| 23                           | 9.03075         | 33.18                | Qp  | 0            | .2              | 10.1         | 43.48                  | 60                        | -16.52         | -                          | -                     |
| 24                           | 9.03075         | 27.74                | Ca  | 0            | .2              | 10.1         | 38.04                  | -                         | -              | 50                         | -11.96                |

Qp - Quasi-Peak detector

Ca - CISPR average detection

## 12. SETUP PHOTOS

Please refer to 13019133-EP1V1 FCC IC Setup Photos for setup photos

**END OF TEST REPORT**